POPULAR MECHANICS

MAGAZINE

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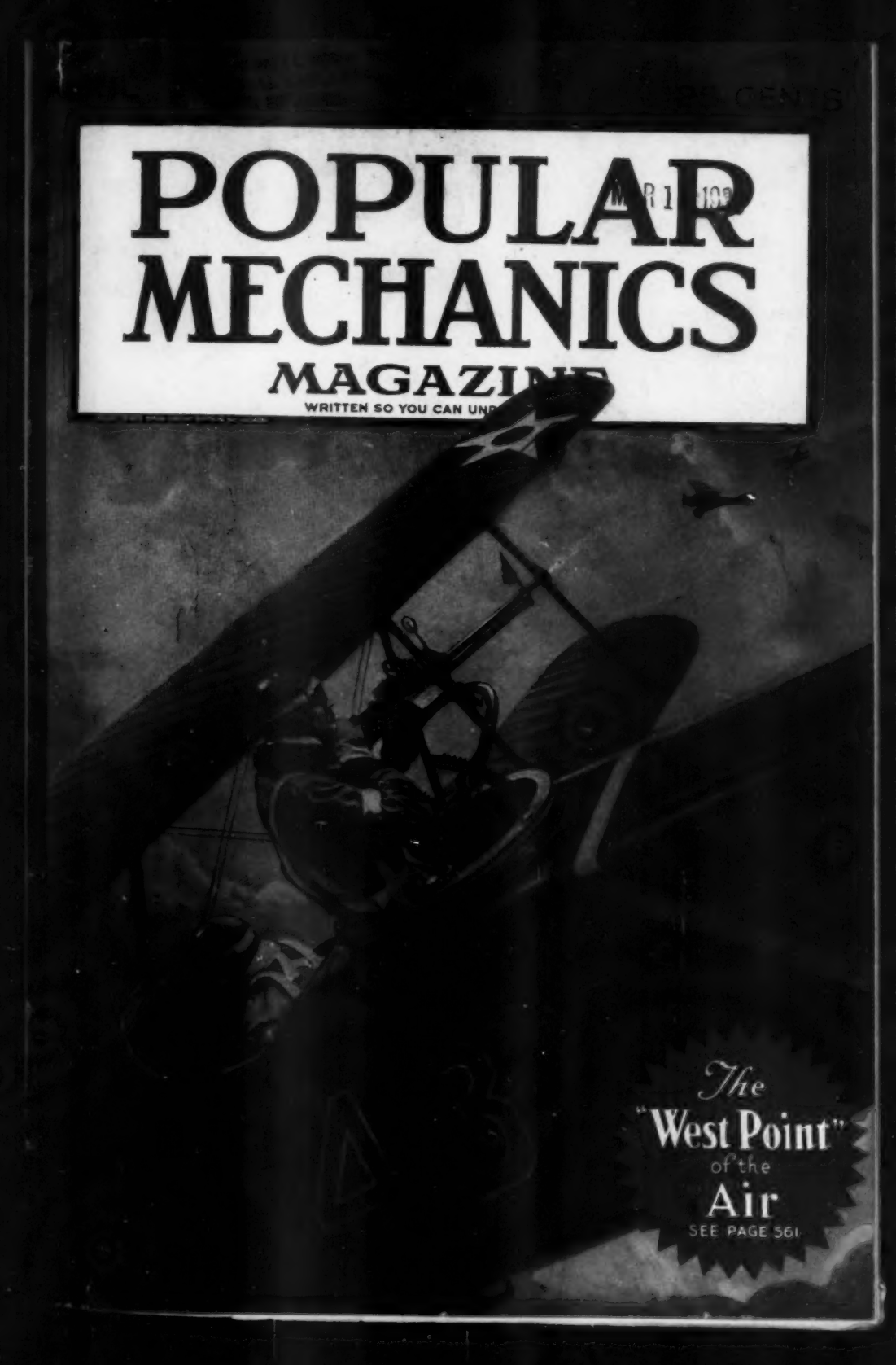

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How'd you like to play this instrument? Free easy lessons show you how . . . 5 days' trial in your own home . . . a year to pay!

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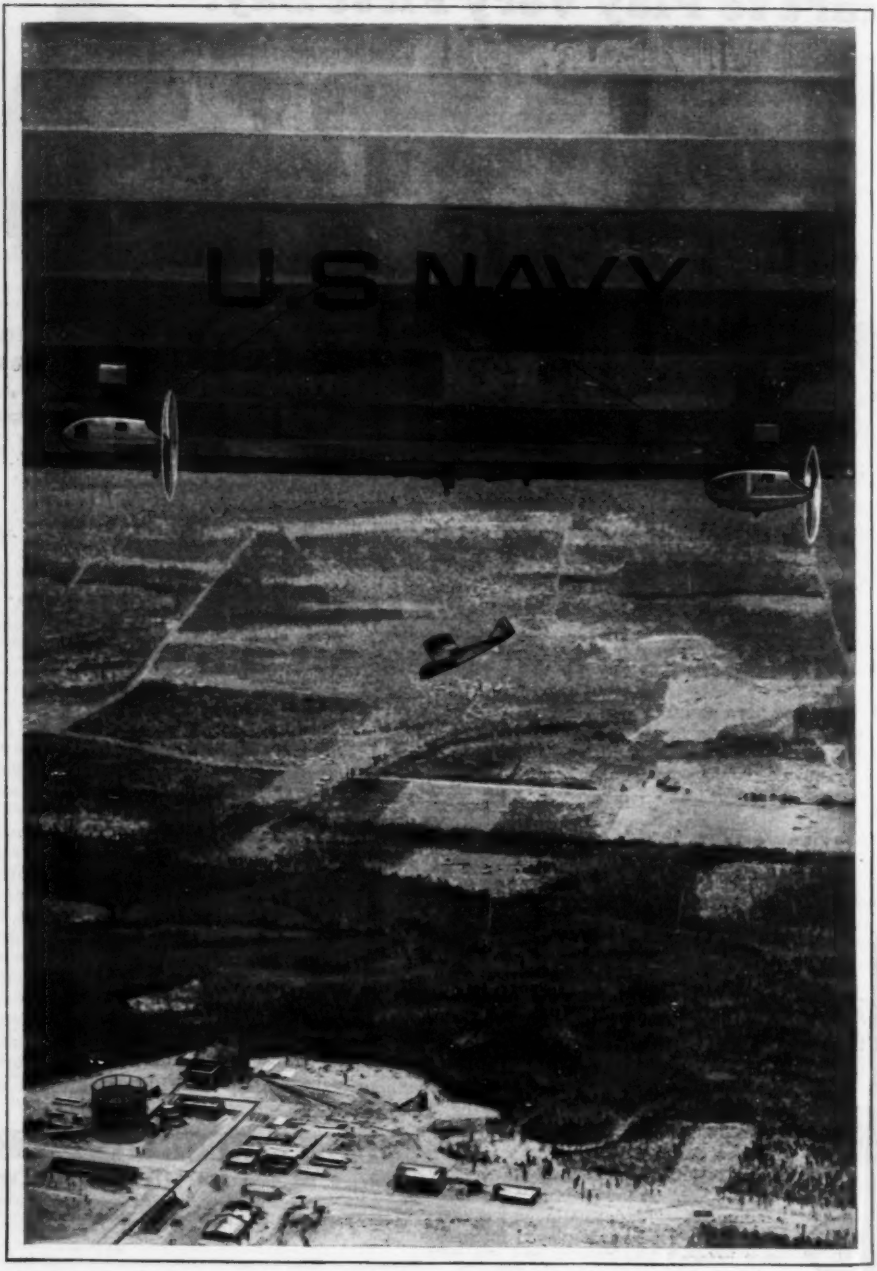

Launching a Glider from the Dirigible "Los Angeles" at a Height of 3,000 Feet over Lakehurst, N. J.; a Naval Officer Kept the Glider under Control, Descending in Eight Minutes

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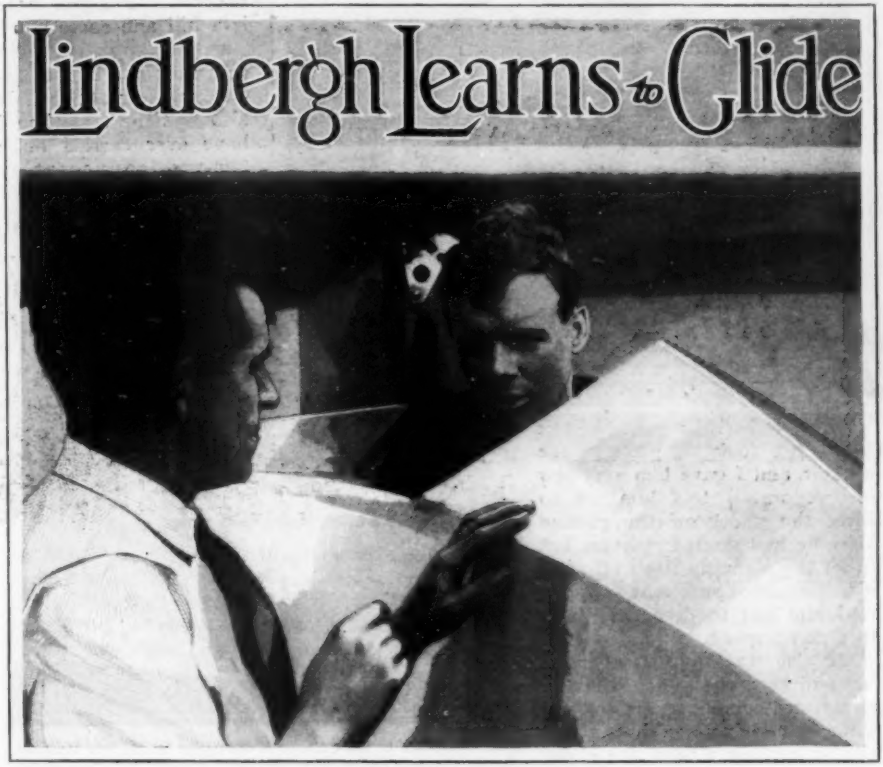
Lindbergh Learns to Glide



By WILLIAM H. BOWLUS

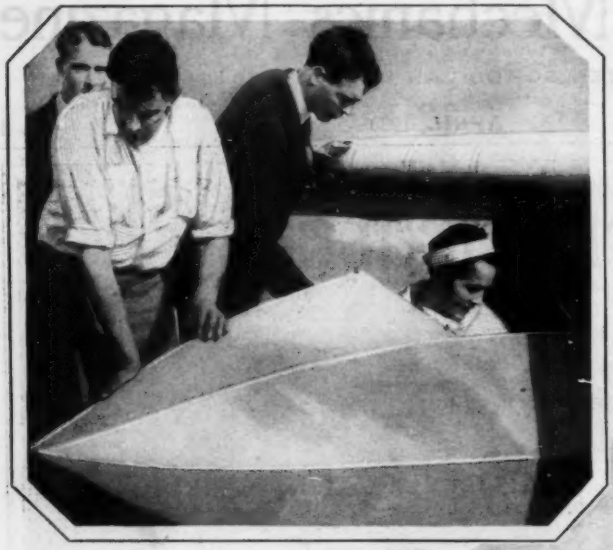
(Holder of the American Glider Endurance Record)

WE WERE standing on the crest of Point Loma, that narrow tongue of land which separates San Diego bay from the Pacific ocean, looking down the precipitous cliffs that lead into the sea—700 feet, almost straight down!

"You don't fly here, do you?" asked Col. Charles A. Lindbergh, who had come with me to the crest of the Point, where we planned to fly in a sailplane. "Where do you land?"

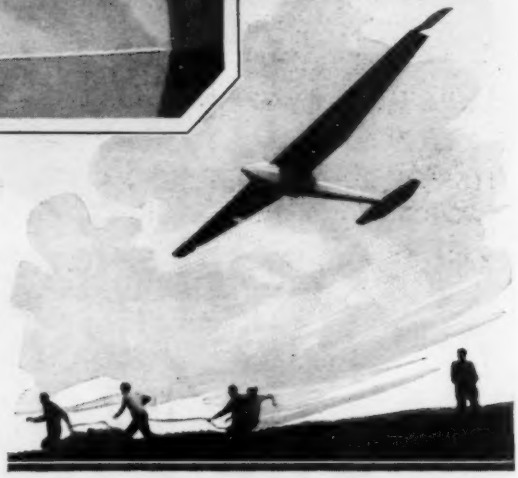
I explained that it was safe enough to take off into the wind over the Pacific in a light glider, and that, should necessity arise, a landing could be made in the brush near the cliffs or on the roadway.

The day was ideal for gliding. I was willing to prove that he would encounter no unusual difficulties in being shot into the air from the top of the Point, and to demonstrate the ease with which one may operate a glider, I had the crew manning the shock cords shoot me out over the ocean and for fifteen minutes I sailed about near the point where Colonel Lindbergh watched my maneuvers.



zon longer than five minutes and returning to his point of departure.

"It was great sport," he commented as he stepped from the tiny cockpit. "All you need is a hill and some wind. This was my first flight in a sailplane but it certainly was great sport. It also was the first time I have ever carried on a two-way conversation from plane to ground."



Mrs. Lindbergh in the Cockpit of the Glider While Her Husband Looks On, and, Below, Mrs. Lindbergh Starting Her First Glide

After I had landed, Colonel Lindbergh took his place in the cockpit, and I gave him very few instructions. I told him not to force the glider off the ground after he had started moving, but to let the plane fly itself off after it had attained sufficient speed. I told him not to dive the glider to pick up speed.

He also was to remember always to turn the glider while in an upward current of air and not while flying in a down draft. Usually, in making a turn, the glider loses altitude, and if this is attempted while in a down draft, the pilot suffers a double loss—the normal loss of altitude by the plane itself and the sinking due to the air moving downward.

Since sail flying involves use of energy derived solely from air currents, Colonel Lindbergh's exhibition of remaining in the air thirty-one minutes in this first attempt, and to maneuver it sufficiently, was a considerable tribute to his ability as a pilot. Once he actually climbed 150 feet while making a turn.

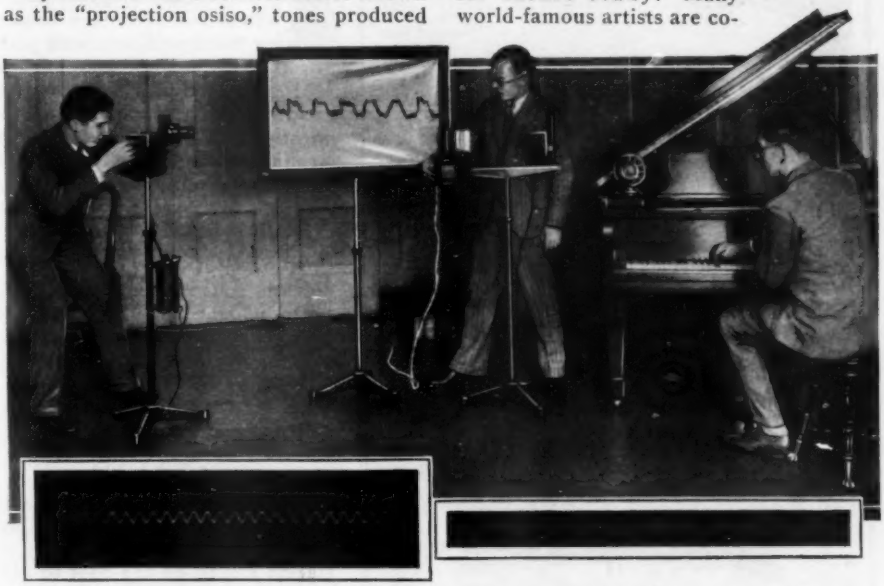
During the flight Colonel Lindbergh qualified for a first-class glider pilot's license No. 9, in the United States. He achieved this by remaining above the horizon longer than five minutes and returning to his point of departure.

One explanation for Colonel Lindbergh's success in gliding a relatively long distance lies in the fact that the glider, owing to its extremely light weight, can soar three times as far as an airplane before it comes to earth. Should the wind fail while the light craft is slowly descending, the pilot has plenty of time to find an air current that will buoy him up again. These rising breezes are not found by accident. Colonel Lindbergh, being an experienced pilot, knew just where to look for them.

After her husband's flight, Mrs. Lindbergh went up alone and succeeded in staying in the air nine minutes.

VISIBLE SOUNDS REVEAL THE SECRETS OF MUSIC

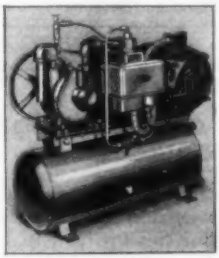
By means of an electrical device known as the "projection osiso," tones produced by voice or instrument are seen as lines of patterned light moving across a screen. The apparatus was developed primarily to study the "steel heart of music," that is, the sounds made by the strings of pianos and other instruments, but it has a wider application. With it, a singer can see the forms of the sounds his throat is making. Teachers are given a visible means of showing the correct manner of speaking or singing. Each tone is accompanied by its moving pattern, the shape of which reveals the quality of the sound. The width of the pattern indicates the volume. The apparatus consists of a microphone which picks up the sounds and translates them into electrical current. This current, in turn, vibrates a small mirror. The glass reflects a beam of light across another mirror with the result that the original tone reaches the screen as a dancing line of light, varying in pattern and size. Sound photographs of the voices of great singers and of the tones produced by famous pianists and other musicians are being taken by this method and preserved for future study. Many world-famous artists are cooperating with the acoustic laboratory of the American Steel and Wire company in this work.

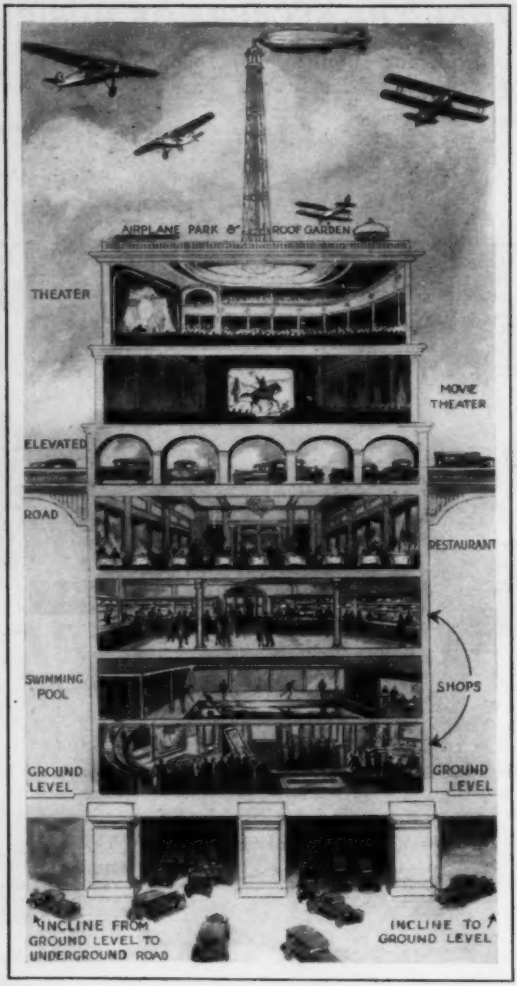


Making a Visible Record of a Piano Note, and, in Insets Below, Two Sound Patterns; at Left, Vibrations from a Tuning Fork, and, at Right, the Same Note as Played by a Violin

VAPOR-GAS SERVICE FOR HOME IS FREE FROM DANGER

Forcing air at controlled pressure into a tank partly filled with liquefied natural gas, a compressor unit now makes possible a vapor-gas service for homes regardless of their distance from gas mains. The tank containing the liquefied gas is buried outside the home, while the compressor is installed in the basement and connected to the tank with pipes. Other pipes carry the vapor gas formed to cookstoves, water heaters or fireplaces. Automatic safety devices are incorporated.





Courtesy The London Daily News

Plans for London Department Store, Including Mooring Mast on Roof, Theaters, Swimming Pool and Radio Room

MOORING MAST ON STORE ROOF FOR DIRIGIBLES

Plans for a skyscraper London department store include provision for a mooring mast on the roof for small private dirigibles, and a park for private airplanes, as well as elaborate roof gardens. A theater and movie house will occupy the upper floors of the building, while batteries of escalators rising spirally from the ground floor will lead to swimming pool, dressing rooms, barber and beauty shops, libraries, post offices and television rooms. Moving floors and revolving platforms will convey merchandise and customers, and an elevated roadway will pass through one of the top floors, while beneath the ground will be streets and space for parking automobiles.

BIRDS MAKE TROUBLE FOR BROADCASTERS

Birds roosting on the antenna of radio station WFI, Philadelphia, have caused trouble to the control operators. A few birds perched on the wires cause an appreciable change in frequency, and a flock means real trouble. To keep the birds away, the operators hit upon the plan of discharging blank cartridges, and during the sending of evening programs, it often is necessary to station a man on the roof to discharge a gun at regular intervals to force the birds to vacate.

ROTATING CLUTCH GRIPS HOSE WITHOUT SCREWS

Gripping an air, steam, gas or water hose so tight that it is leakproof, yet requiring no screws, threads, nuts, springs, wires or washers to install, a rotating-clutch hose fitting now is available. The fitting is adjustable to the varied thickness of hose walls and the parts include an external or internal pipe thread attached to the clutch which opens or closes to grip or release the hose by turning a boss sleeve at the hose end. For connecting broken hose a hose-to-hose unit is provided, consisting of two hose couplings swiveled at the center. Heavy metal hose couplings are unnecessary when the units are employed.

Various Units of a Rotating-Clutch Hose Fitting Which Grips without Screws or Washers

COLOR-BLINDNESS CORRECTED BY SPECIAL LENSES

A Berlin scientist has developed a special lens to correct the abnormality of vision resulting from red and green color-blindness. The special glass accomplishes its purpose by the incorporation of two chemicals which filter some of the spectral colors of light passing through glass. The fullest action of these chemicals is seen in the orange-yellow range between the red and green, thus exaggerating the contrast and assisting the color-blind to distinguish between them. Temporary pathological color-blindness—usually for the greens and blues—comes under another category. Relief for such difficulties often can be obtained only by removing the cause, which sometimes is a center of infection.

HAND-DRIVEN VALVE GRINDER WORKS LIKE AUGER

Valve grinding by hand is made easy with a tool which in some respects operates like an auger, except that the grinding motion is accomplished by pushing an inclosing frame up and down over a spiral rod so designed as to give the reaming apparatus a reverse motion five times for each stroke. Both handle and support are equipped with roller bearings and there is no crank. A sliding arm in the base is adjustable to any-size valve, and a rubber vacuum-cup attachment is provided for Fords.

Self-Operated Lifeline to Escape from Fire, the Person Clinging to the Line Governing the Speed of Descent to the Ground

LIFELINE TO ESCAPE FROM FIRE IS SELF-OPERATED

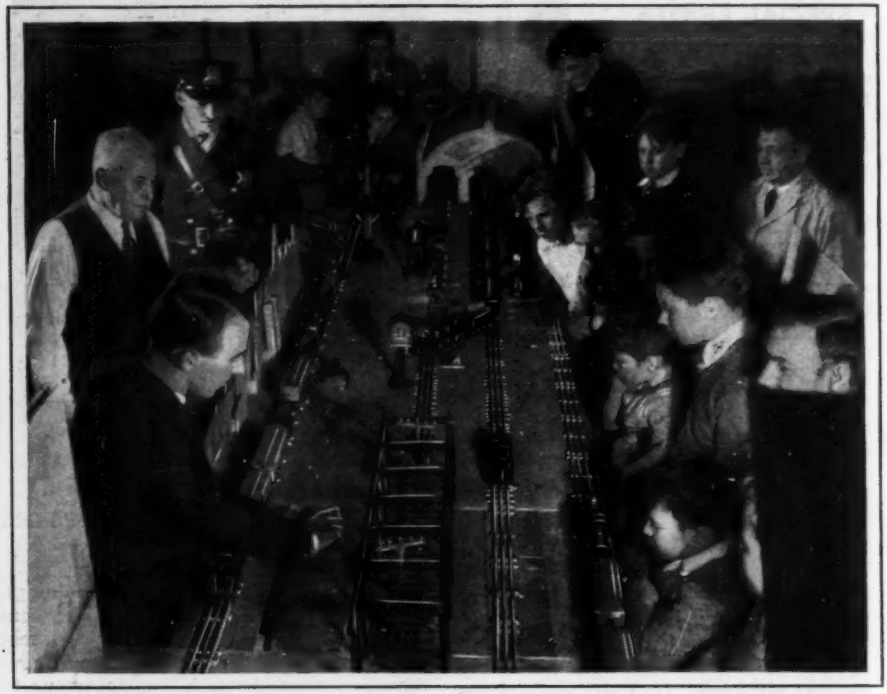
For the use of tenants in tall buildings, a self-operated lifeline recently underwent successful tests in London. The descent of the person clinging to the line is governed by him through the apparatus to which he clings. The safety device is portable and quickly attached to any substantial object for a rapid descent. Because of the manner in which the line is payed out, the apparatus is called the "spider" lifeline.

REFLECTORS SET IN FISH LURE RESEMBLE RED EYES

Providing a lifelike lure for fish, a spoon in which reflectors have been set now is on the market. As the lure moves about in the water, the reflectors cast rays of light and resemble red eyes set in a living head.

¶The buffalo has replaced the eagle on the seal of the department of the interior.

MODEL RAILWAY PROVIDES INSTRUCTION AND FUN



Perry A. Ball, at Left in Foreground, Teaching Class of Boys and Men Some of the Principles of Railroading by Means of Miniature System That Closely Duplicates a Real Railway

A complete railway system, in miniature, has been installed in a Chicago office building to teach boys, and men, too, many of the details of railroading. Here, on nearly 1,000 feet of track, representing the distance from Chicago to San Francisco, and with scores of engines, cars, signal towers and switches, all operated by electricity, youngsters and their fathers learn how to route trains, manage terminals, maintain schedules and execute other operations necessary in the running of a real railroad. Work and play are combined as the pupils are taught how to install and repair the units, are instructed in some of the primary principles of electricity and, at the same time, are given valuable information in geography, as the area represented corresponds to that of the western part of the United States.

BOOTLEG LIQUOR RUNS MOTOR WITH FUEL VAPORIZER

Confiscated bootleg liquor has been used successfully as fuel for an army truck, without any engine changes, in tests made by army engineers with a fuel vaporizer, the invention of an Englishman. The vaporizer enables the use of cheaper fuel, including alcohol and low-grade gasoline, and at the same time develops more power. The army report said that the efficiency of a truck engine was increased from a peak of fifty-two horsepower to more than sixty-nine horsepower, and at the same time the deadly carbon-monoxide content of the exhaust gases was decreased. The device slows down the fuel on its way to the cylinders in a chamber equal in capacity to one cylinder. This chamber is so constructed that the incoming charge is subjected to

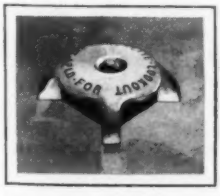
centrifugal action, the heavier particles being thrown outward, the speed of the gas supplying the necessary force. The unvaporized fuel is spread on a heated surface which varies in temperature from the bottom upward, the lighter fuels being vaporized at once and the heavier ones flowing down until they reach a portion hot enough to turn them to gas. A total heating surface of 2,000 square inches within the chamber vaporizes the mixture of fuel and air entirely before any of it enters the intake manifold, requiring no alteration in compression when different fuel is employed.

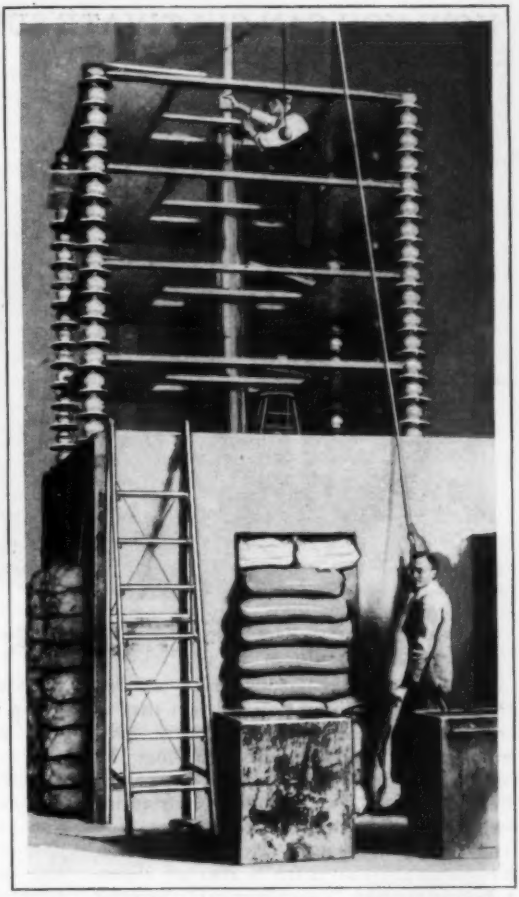
MORNING GLORY PETALS FOR ACID TEST

Morning glory petals may be used to detect acidity in the same manner as litmus paper. In the presence of acid, the blue litmus paper turns red, and in an alkaline solution turns blue again. The petals of the blue morning glory react in the same manner. Red cabbage or its juice also may be used for the same purpose.

REFLECTOR GIVES SIGNAL OF CAR'S APPROACH FROM SIDE STREET

Signaling to the motorist the approach of a car from a side street before it reaches the corner, a mechanical policeman in the form of a street-intersection light reflector has been placed on duty at busy corners in San Francisco. The reflector rises a few inches above the pavement and by means of red-glass squares in its base light from each approaching automobile is diverted at right angles and warns motorists coming from either cross direction before any of the cars can reach the intersection.





Million-Volt X-Ray Machine, Most Powerful in the World Which Is Capable of Penetrating an Inch of Lead

MILLION-VOLT X-RAY MACHINE PENETRATES INCH OF LEAD

Capable of penetrating an inch of lead, a million-volt X-ray machine has been installed in the high-tension laboratory of the California Institute of Technology. The machine constitutes the most powerful X-ray apparatus in the world, and stands some twenty feet high.

¶Popular Mechanics Magazine does not publish the name of the maker or seller of any device described in its pages, but this information will be furnished free on application to our Bureau of Information.

HOW YOU CAN CULTIVATE SUPER-NORMAL SENSES

Exercises for Cultivating Keen Senses; at Top, a Test for Eyes, Mind and Nerves; Below, Counting the Number of Dots on a Card at a Glance; Right, Developing Steady Nerves

Some time ago a business man startled his associates with an unusual feat that at first was ascribed to stage trickery. No wonder, for he demonstrated that he could, at a single glance of two seconds' duration, read and memorize an entire page of printed or typewritten matter. Far from being abnormal, science has made the discovery that such a feat of vision is better termed "super-normal," because anyone can, in a greater or less degree, depending on the training and patience given in acquiring proficiency, duplicate this and other seemingly astounding demonstrations.

As being simply a matter of practice, the feats are comparable to the ability of the expert marksman in scoring a bull's-eye without sighting his revolver, and the ability to do them may be cultivated. Place a number of black dots, five, for instance, on a sheet of white paper, and a person of average ability should be able, at a single glance, to state the number without counting individual dots. Increase the number to six, and it is slightly more difficult; yet, when one has mastered this step, the mind and eyes are trained to a new ability which is ready to grasp more difficult tests. With ten minutes' practice each day for a week or two, the eye will become accustomed to the routine, and, in a short time, you will be able to count at a glance up to twenty-five and more dots. After this has been accomplished, a more interesting daily training may be undertaken. Select a book containing short printed paragraphs. Cover all but the first line with a sheet of paper and in one glance try to perceive and memorize the entire line. Continue with other lines; when you become proficient, two lines, then an entire paragraph. Daily and patient practice will prove that you can understand printed paragraphs in half the usual time, and that what you read clings more tenaciously in the memory.

Another exercise is quite as simple and promotes mental agility and the power of quick decision. Following is a list of words, each having a certain meaning. As you read each one write down a word of exactly the opposite meaning. This must be done as rapidly as you possibly can, and at a glance, as for example, sweet—sour.

Wear	Angry	Raise	Lose
Burn	Fall	Repair	Learn
Lack	Finish	Write	Mar

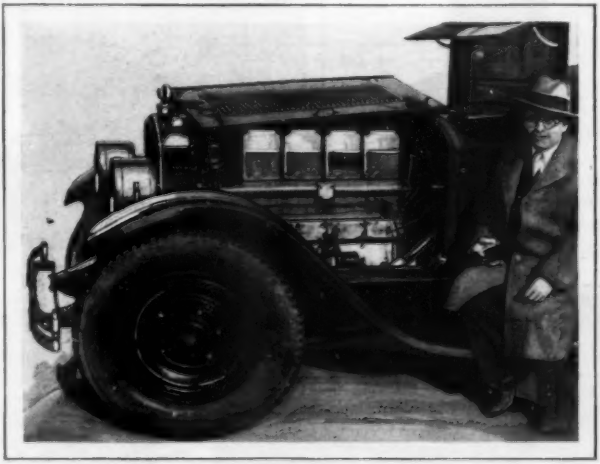
The list requires no more than a minute to complete. Select a like number of other words and try to do them in less time. Practiced daily, the procedure soon gives a super-normal quickness to the mental machinery.

How are your nerves? A man of iron nerves can control the muscles of his body so that fidgets is an unknown term to him. Steady nerves are an asset; you can test yours with a two-foot length of string with a pellet suspended from the end. Can you hold the end of the string at arm's length steady enough so that the ball will remain perfectly still? You can secure super-normal nerve control in a short time with this apparatus. When you have mastered the two-foot length, shorten the string an inch at a time until you can hold the lead pellet without moving at the end of three inches or less of string. These practices, if carried out patiently and consistently, give both the eyes, mind and nerves super-normal ability. How about co-ordination between the three? Do they work together efficiently? The track man trains his nerves to respond at the crack of a pistol shot. Could you do the same? Quite easily, with practice.

Cut a twelve-inch disk from a sheet of heavy white cardboard, and through the exact center run a spindle or axle on which it will revolve freely. Along the edge, paint a one-inch black square. Another disk, slightly larger, is placed over the first on the spindle and is to remain stationary. A one-inch square window is cut out along the edge so that the black square can be seen through it. Now give the first disk a spin with the finger; it should make several complete revolutions a second. Each time it goes around the black square will flash momentarily past the little window. Spin the disk again and in the right hand have ready a pencil posed over the little window opening. As soon as you see the black square, jab at it with the pencil. This will leave a pencil mark on the disk, and its distance from the square shows that your mind, nerves and muscles required quite a large fraction of a second to heed the impulse of the eyes. Try again. In a short time you find that you are becoming more and more proficient in the last as well as in the former tests; soon your eyes, nerves and muscles are found more adept. But do not stop practicing, for you are on the road to possession of unusual, acute senses that are decidedly out of the ordinary—super-normal, in fact.

DIESEL ENGINE IN AUTOMOBILE FURNISHES CHEAP POWER

After a journey of 792 miles at a fuel cost of $1.38, an automobile equipped with a Diesel engine was demonstrated recently in New York. On the trip the machine used thirty gallons of heavy fuel oil instead of gasoline. The motor is a four-cylinder engine mounted on a standard passenger-car chassis, the engine itself being of the standard type used in portable and marine work, and not built particularly for the automobile in which it was used to test the feasibility of employing such power for the propulsion of cars.

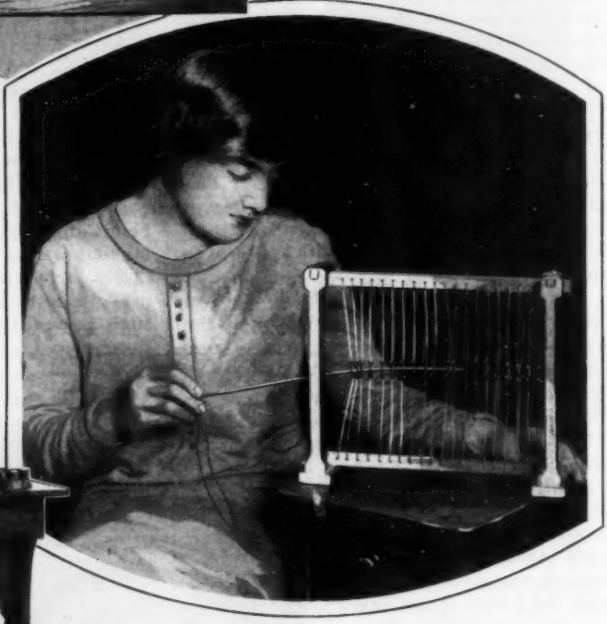


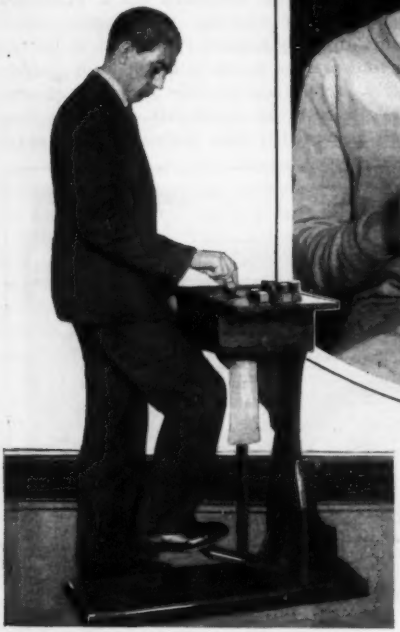
Diesel Engine in Standard Car Chassis; the Auto Traveled 792 Miles with This Motor at a Fuel Cost of $1.38

"STUNTS" SHOW WAY IN THE CHOICE OF A CAREER

Tests for Boys and Girls of All Ages, to Find Out for Which Career They Are Best Suited, Are Given at the National Institute of Industrial Psychology to Prevent a Wrong Choice

Tests Illustrated on This Page Reveal the Presence or Lack of Mechanical Ability in the Candidates





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Examiners Do Not Rely Wholly on the Tests to Analyze Their Subjects, but Study Their Temperaments and Physical Attributes as Well; the "Stunts" Often Show That a Boy or Girl Has a Talent Which Has Not Received Adequate Cultivation and Likewise Reveal That There Are Certain Lines of Work for Which the Youth Is Probably Physically and Mentally Unfit; Ignorant or Unmindful of These Limitations, Many Boys and Girls Embark on Careers in Which They Have Only the Slightest Chance of Succeeding, Simply Because They Are "Square Pegs in Round Holes"

EXACT COLOR SHADE RECORDED BY ANALYZING APPARATUS

Far more accurate and sensitive than the human eye, a color-analyzing apparatus has been made by two University of Pennsylvania scientists which will record in black and white on a photographic plate a shade of color so that it can be matched exactly by some one hundreds of miles distant. Placing the colored object in the apparatus and turning a crank is all that is necessary for it to analyze the color, but the apparatus itself is not so simple as its operation. The entire mechanism is contained in a box no larger than a radio cabinet and operates from an electric-light socket or bank of batteries. The sample to be tested is placed over a rectangular opening in the top of the box where it is illuminated by a powerful source of light. The light reflected from the sample passes into a spectroscope which separates it into its component colors. A portion of the dispersed light then enters a photo-electric cell attached to amplifying apparatus which records the current passed by the cell as a result of the light excitation, both on a measuring instrument and on a photographic film. By turning the crank, different parts of the spectrum are successively admitted to the photo-electric cell until the entire range has been covered, the film moving through a corresponding distance.

AUTOMATIC ELECTRIC PRIMER STARTS AUTO IN WINTER

To facilitate starting the automobile in cold weather, an automatic electric primer which operates when the starter is depressed, now is on the market. It contains a heavy-duty filament which heats to 650 degrees, vaporizing the first charge of gas drawn into the cylinders and giving the effect of starting a warm motor. It cuts off when the starter is released. Thus it helps increase life of batteries.

Preparing Wax Form to Hold the Acid against Revolver, and, Below, Restored Numbers on Auto Frame

CHEMICAL TO COMBAT CRIME RESTORES AUTO NUMBERS

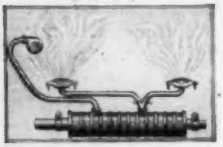
Numbers on automobile parts, guns, watches and other metal articles, mutilated or partly obliterated by thieves in an effort to baffle identification, may be restored with a chemical prepared by members of the stolen-automobile detail of Chicago's police department. The chemical, in liquid form, is applied to the part where the original number is believed to be. In five minutes or five hours, perhaps, depending upon the kind of metal and the degree to which the old characters have been worn away or obscured, the faint outlines of the original numbers usually can be seen. Special lights and magnifying glasses are sometimes necessary, but usually the digits are visible to the unaided eye. The restoration is generally not permanent but lasts long enough to permit an accurate tracing of the numbers. More than 100 automobiles, many guns, watches and other articles thus have been identified by the chemical squad.

Drawing to Show How the Shadow Dance Is Produced; in the Ballroom, Guests See the Shadow and the Real Dancer as Well

DANCE ON BALLROOM WALLS LATEST SHADOW NOVELTY

Shadows of entertainers are made to dance on the walls of the Bal Tabarin in Chicago's Hotel Sherman, where light is used exclusively for interior decoration. The effect is produced by having the dancers stand before projectors which are installed over the false ceiling above the ballroom floor. Their shadows are thus cast upon the walls. Curious and novel results are obtained by this system when the dancers appear against various backgrounds. For instance, bathing girls can be made to look as though they were plunging into a sea, divers walk under an ocean and other effects are produced. From certain parts of the ballroom, patrons may see the performers on the runway as well as their shadows.

AUTO HEATER DRAWS PURE AIR THROUGH WARMING CHAMBER



Adapting the home-heating principle to the motor car, an auto heater now is on the market which draws pure air into a heating chamber and then circulates it through the car. It consists of a fan controlled by a two-speed switch which draws fresh air into a chamber around the muffler, where it is heated and then passed into the car through floor registers. In summer, the fan may be used to cool the car.

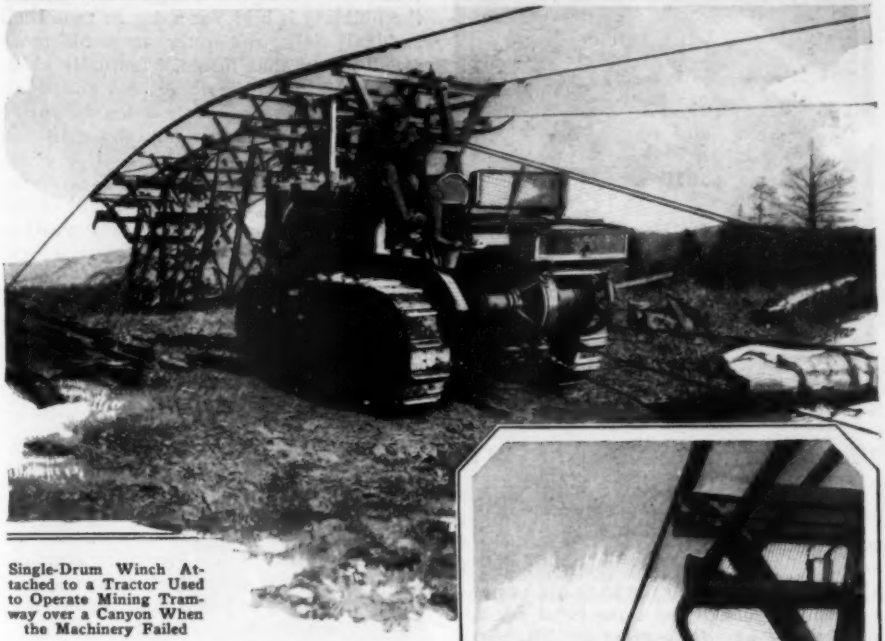
HARDEST METAL GOES UP AS NEW USES FOR IT ARE FOUND

Tungsten carbide, the hardest compound known to science, is constantly finding new uses, and as a result, it is now worth nearly $500 a pound. Regarded for many years as little more than a curiosity, this compound of tungsten and carbon, both soft, is used principally for the cutting of metals. Experiments have shown that tungsten-carbide tools for machining operations far outlast the ordinary high-speed steel tools, and it has been used successfully in working with manganese steel, armor plate, bronze and bakelite. The metal, which will even scratch a sapphire, is being produced under various trade names.

RADIO-SET NOISE IS REDUCED BY SPECIAL FILTER

Capable of eliminating radio interference from supply lines or household electrical devices, two types of filter have been placed on the market. The filters may be attached between the electrical device causing interference and the power supply, or between the radio set itself and the power outlet if the source of interference cannot be readily determined. Each is fitted with connecting attachments so they may be changed easily from one appliance to another. The stronger filter is intended for use with household devices operated from alternating or direct-current motors, and the other for appliances commonly connected to power lines by a cord and plug.

TRACTOR RUNS TRAMWAY SPANNING A MOUNTAIN

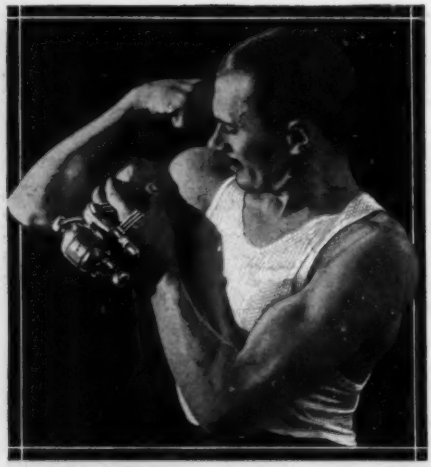


Single-Drum Winch Attached to a Tractor Used to Operate Mining Tramway over a Canyon When the Machinery Failed

When machinery failed on the long mining tramway spanning rough, mountainous country in New Mexico, and lead and zinc ore could not be transported from the mine to the mill across a canyon, a tractor was pressed into service to operate the tram until the machinery could be repaired. A single-drum winch was attached to the tractor which furnished the power to carry fully loaded ore cars up over the 8,500-foot summit of Pecos canyon as empties were dropped down the other side in readiness for loading.

THIEVES USE OWN BROADCAST TO JAM POLICE SIGNALS

Thieves in London are employing their own broadcasting set to frustrate the radio-signal system of Scotland Yard Recently when the police attempted to broadcast to squad cars the news of a jewelry-store robbery, it was found that the squads could not pick up the signals because some secret station, using the same wavelength, began oscillating and jamming the police messages. Using an interference locator, repeated efforts have been made to trace the offender, but unsuccessfully because it only operates when the police broadcast information of crimes.



Small Electric Vibrator Which Fits on Hand and Transmits Its Energy through the Fingers

VIBRATOR ON HAND TRANSMITS ENERGY THROUGH FINGERS

Weighing little more than one pound, a midget electric vibrator now is on the market which transmits energy through the fingers. It fits on the back of the hand and the fingers of the same hand are applied to the part to be treated. The small instrument and the finger transmission make possible a concentrated local self-treatment on most parts of the body.

RAIN FALLS INSIDE AIRDROME AS SUN SHINES OUTSIDE

Probably the only building in the world that has its own weather, including rain, fog and clouds, is the big nine-acre airship factory and dirigible dock located at Akron, Ohio. Sudden changes in temperature last winter revealed that it can be raining quite vigorously inside the structure while the sun shines brightly outside, and the presence of fog and clouds has become common to men whose heads often protrude above the clouds while their bodies are obscured as they labor at various heights. When the temperature outside the building is high for a day or two, then suddenly falls, the outer air cools more rapidly than that inside, eventually chilling the steel plates of the roof and sides, and causing the moisture-laden air inside to condense and fall as rain. Rainfall also has resulted from the movement of warm air from around machines and assembly operations upward to the cold sides of the dock. The building's independent weather is giving engineers considerable concern, as rainfall is a serious matter in some of the operations of airship building. In an attempt to control the condition, a strip along the roof was insulated with a one-inch layer of a special compound, and it may be necessary to extend this costly insulation down the sides. One way of stopping the interior rainfall, of course, would be to open the huge doors at the ends of the dock and let air currents drive out the moisture, but this is costly and the rush of air through the structure often is objectionable. The structure contains about 45,000,000 cubic feet of space, and consequently is so large that heating it is entirely out of the question.

ELECTRIC SLEEPING BLANKET FOR WINTER WEATHER

Sleeping in comfort with windows open in the coldest weather is made possible with an electric blanket now on the market which is particularly adapted for the use of persons whose health requires much fresh air, even in zero weather. The blanket is full single-bed size and weighs about the same as an ordinary comforter. It plugs into a light socket, contains a heat regulator, costs little to operate and is protected from short-circuiting or overheating. The heating apparatus is covered with purple sateen, so that the appearance differs in no way from that of an ordinary quilt.

Electric Sleeping Blanket Which Operates like Heating Pad to Keep User Warm

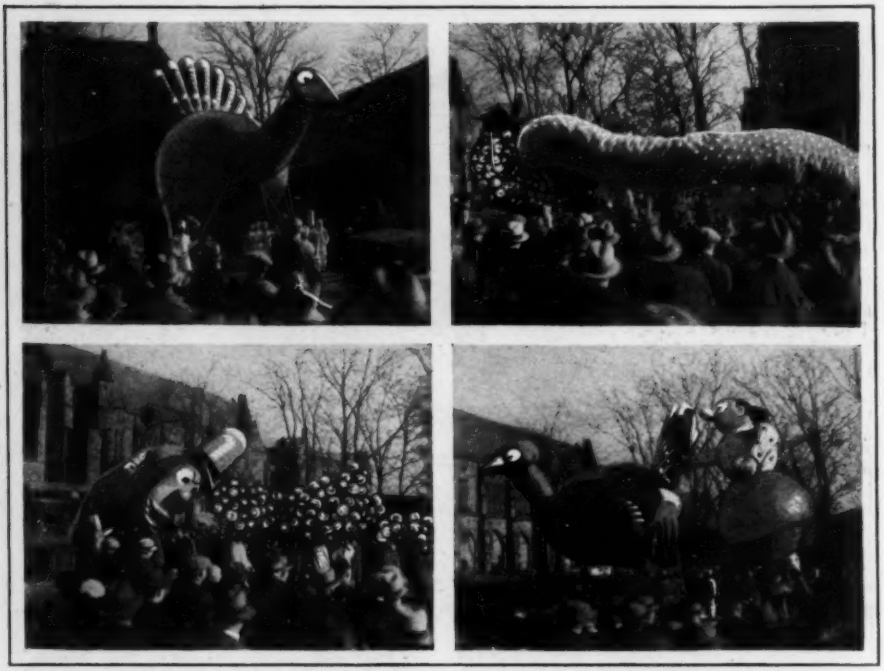
WASHINGTON'S FACE IS CARVED IN MOUNTAIN ROCK

Scene in National Monument Memorial Park, Showing Head of Washington, One of the Four Figures of Presidents of the United States Which Are Being Carved on Mount Rushmore by Gutzon Borglum; at Left, Taking Measurements at the Tip of Washington's Nose

© Publishers' Photo Service

Mr. Borglum Working on Model of Mount Rushmore Memorial, Which, When Completed, Will Display the Figures of Four Presidents; in the Distance, through the Plate-Glass Window, Can Be Seen the Real Mount Rushmore and the Partly Completed Face of Washington; the Park Is Located in the Black Hills of South Dakota and Is Expected to Become a Mecca for Thousands of Tourists

BIG ANIMALS HELIUM-FILLED FOR STREET PARADE



Huge, Grotesque Animals, Which Appeared in a New York Street Parade; They Were Made of Sections of Rubber Inflated with Helium Gas and Were Held Down by Ropes

Huge inflated balloons made to resemble grotesque animals, dragons and comic-strip characters participated in a New York street parade recently. Except for their shape, the balloons were like the ordinary captive type, but were filled with 12,000 cubic feet of helium gas to eliminate danger of fire. A dragon, 177 feet long, was the largest single piece, but there also was a thirty-five-foot dog standing ten feet high, and a turkey of corresponding proportions, as well as a horse, thirty feet high. After the parade, the balloons were released and floated out over the Atlantic, prizes for their return being offered.

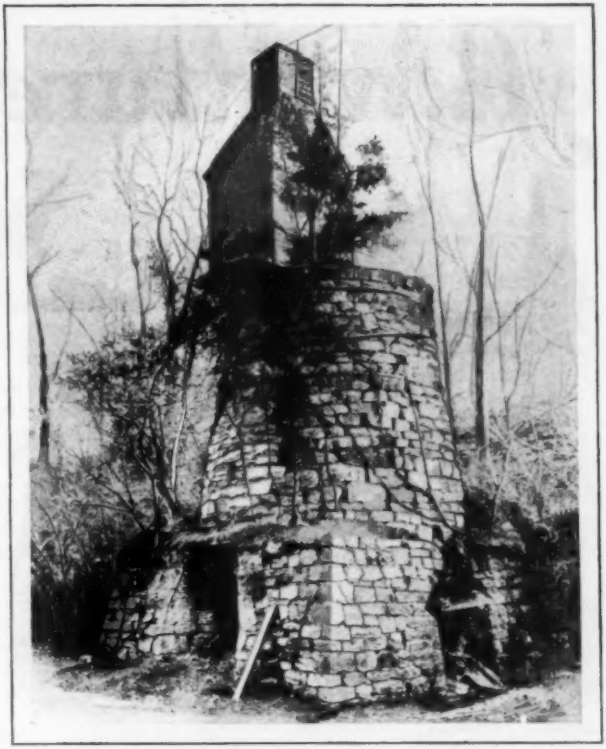
SPARK-PLUG ALLOY MAINTAINS CONSTANT VOLTAGE

For spark-plug electrodes recently developed alloy has been found that requires a considerably lower sparking voltage than the commercial electrode wire, and that also resists corrosion due to the hot gases in the engine cylinder, thus maintaining a constant sparking voltage. Tests have shown that, in the ordinary spark plug, the voltage across the gap may vary as much as fifty per cent from one spark to the next, and that there is a loss of electronic emission from the electrode, much the same as in a radio tube, so that a plug, when old, may require as much as 3,500 more volts from the coil than when new, even if the gap is the same. With the new alloy, the voltage required does not vary, provided the gap is kept constant. This results in easier starting in cold weather, and fewer inspections of spark gaps are needed.

¶We want all our readers to write us freely and often whenever they wish additional information on articles published in this magazine. Address Bureau of Information, Popular Mechanics, Chicago.

FACTS REGARDING GIANT WAVES

Passengers on ships in storms who often imagine waves breaking over the vessel are from eighty to 100 feet high are mistaken, as the greatest actual height reached by a wave is probably not more than forty feet. Persons on a vessel with a deck sixty feet above the water line, naturally assume, when a wave reaches twenty feet above the deck, that it is eighty feet high. The vessel, however, piles up a large bow wave so that even if it were on an even keel when a thirty-foot wave struck, the wave might break aboard a ship whose deck were much higher. Actually the vessel may not be on an even keel when she encounters a wave and besides is actually burrowing into the mountain of water as it hits so that people on the deck think the wave is of tremendous height. Authorities consider that a wave forty feet from trough to crest is about the largest possible, except in the stretch of water between Capetown and Australia, generally considered the roughest bit of ocean in the world.



Codorus Furnace, near York, Pa., Which Turned Out Many of the Cannon and Balls for the Revolution, and Still Is Standing

CANNON CAST FOR REVOLUTION IN PLANT STILL STANDING

Codorus furnace, America's most important munitions factory in the Revolutionary war, still is standing near York, Pa., although today it is little more than a pile of stones which might represent the smokestack of a modern munitions plant. Despite its size, Codorus furnace turned out many of the cannon and cannon balls for General Washington's continental army, and a movement is now under way to restore the plant.

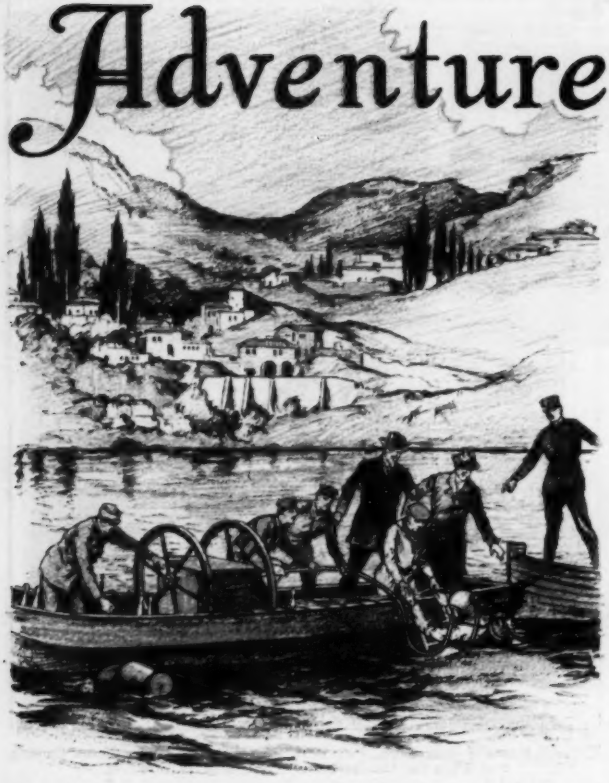
KNIFE CONTAINING TEN TOOLS IS HANDY POCKET KIT

Containing ten tools, a knife now on the market constitutes a pocket tool chest in itself. Besides the blade, the instrument comprises an adjustable spanner, screwdriver, punch, corkscrew, file, tin opener, electric-wire scraper, bottle opener and rule.

ANT EGGS AS GAME-BIRD FEED

Ant eggs form the principal diet of newly hatched quail, pheasants and partridges on several game-bird farms in the west. The dried eggs are imported from South America.

Adventures of



Diver About to Descend to the Bottom of Lake Nemi to Explore the Ancient Sunken Galleys in Search of Treasure

By HAROLD T. WILKINS

"SUCH great progress has been made in deep-sea diving, where a record of 308 feet for ordinary diving dress has been set, that there is now open a possibility of treasure hunting which must fire the imagination." This was the recent remark of Prof. Leonard Hill, of the Royal Society and president of the National Institute of Medical Research of London.

Hardly had these words been uttered than Dr. Thomas Gann, a famous American explorer, announced to listeners-in over the radio in England that he was anxious to get into touch with young healthy men out for adventure and willing to hunt a treasure cache in the unknown jungles of Honduras.

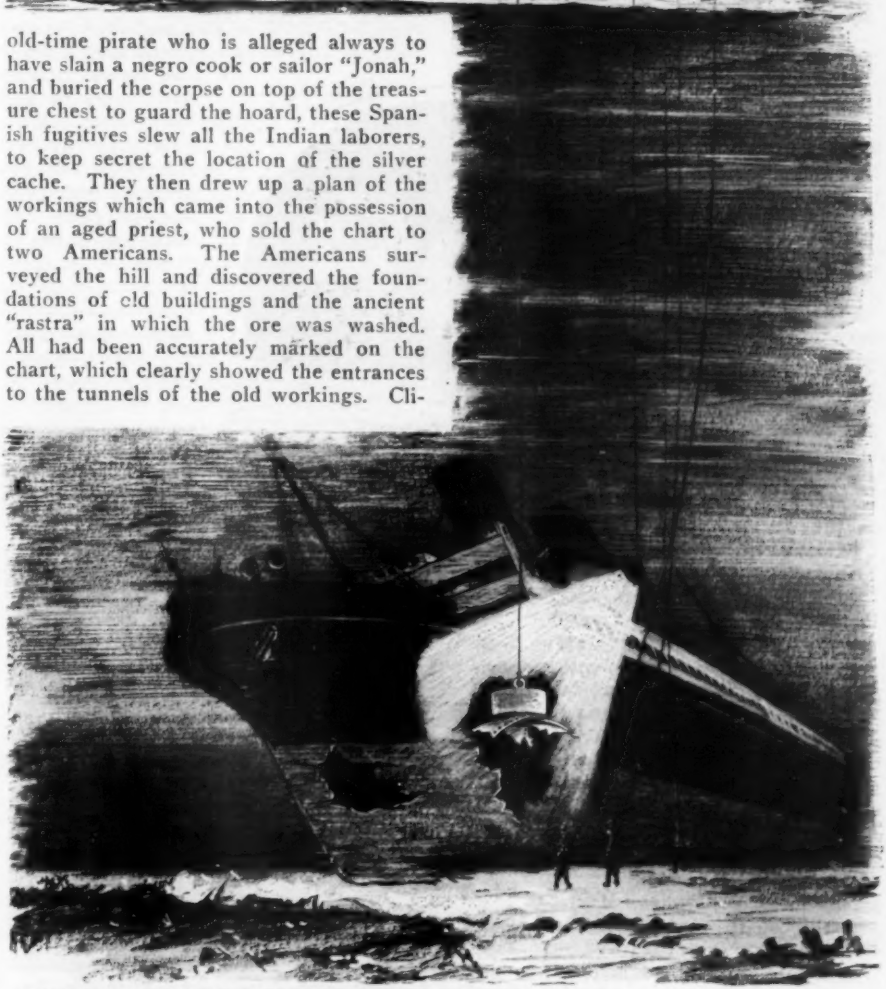
"Some time ago," said Doctor Gann, "I was in Italy, when there came to my hands a treasure chart drawn up by a Mr. Carmichael who, about seventy years ago, was living in Guatemala. A roving band of Indians told him of a lost Aztec treasure temple, buried deep in the jungle. He set out from Te Kow into the bush, and after a long search found the temple but not the treasure. Armed with his chart, I myself set out, in 1927, along with Captain Joyce of the British Museum. We were beaten back by the impassable forest and the lack of water. I am sure the treasure is there, if we can only find it."

Central America holds many romantic treasure caches dating from the days when the old Spanish colonies revolted and piratical craft were raking with their topsails the tall trees and palms of shining coves and islands, all the way from Cuban mangrove swamps and Haitian shores round the Horn to Valparaiso and the lone bays of southern California. Many attempts have been made by generations of long-dead adventurers to locate these hidden treasures, but often chance rather than the shovels, picks and drills of the treasure hunters has laid bare the doubloons and the buried jewels.

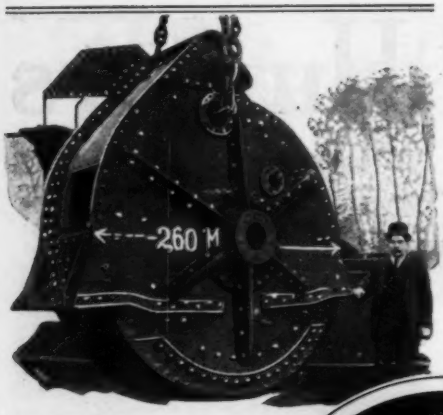
Where, for example, are the treasures of the Mexican hill called the "Lock of the Treasure"? On the jungle-clad slopes of this hill, in southern Mexico, are hidden an immense store of silver ingots. The story is that they were concealed by Spanish miners fleeing from Mexican rebels. Following the example of the

Treasure Hunters

old-time pirate who is alleged always to have slain a negro cook or sailor "Jonah," and buried the corpse on top of the treasure chest to guard the hoard, these Spanish fugitives slew all the Indian laborers, to keep secret the location of the silver cache. They then drew up a plan of the workings which came into the possession of an aged priest, who sold the chart to two Americans. The Americans surveyed the hill and discovered the foundations of old buildings and the ancient "rastra" in which the ore was washed. All had been accurately marked on the chart, which clearly showed the entrances to the tunnels of the old workings. Cli-



Drawing Showing How Huge Electromagnets Are Being Used in an Attempt to Salvage the Treasure from the S. S. "Egypt," Which Sunk in the Bay of Biscay with a Fortune in Gold Bars



matic difficulties and fever are said to have stopped the work on the cache.

Davy Jones may slide shoals and sandbanks over the Spanish treasure-galleon wrecks at sea, but ashore, nature just as effectively piles up hills and sets cliffs tumbling onto pirate caches. The famous Cocos island cache, in the Pacific, off Costa Rica, and Trinidad island, the lone cable station in the South Atlantic, are places where landslides have hurtled tons of rock and debris to bury deeper the graves in which old-time pirates have hidden their ill-gotten hoards. In both cases, it seems not unlikely the treasures will remain hidden till doomsday, unless further landslides or earthquakes again expose them.

A few months ago, a farmer, Francis Calderon, was plowing on his land in Oaxaca, Mexico, when the shares turned up buried treasure worth more than $250,000. The estate, which had belonged to Senor Calderon's family for more than 150 years, was seized in 1815 and held for five years by a bandit gang under the famous Mexican leader "El Solo," so named because of his daring single-handed robberies. He is known to have buried a large part of his loot. It is likely that the farmer has unearthed one of El Solo's caches.

Lives have been lost and fortunes spent in the attempt to locate the mysterious Inca cache of treasure at Sacambaja, on the eastern slopes of the Andes, near La Paz, Bolivia. One account says that there are hidden in a hill on the banks of this river $60,000,000 in gold and silver, buried there in 1767, when a Spanish king ordered the monks who lived there to quit his South American dominions. Another story—probably the truer one—is that the cache was made by Peruvian Indians in the days of the conquistadores Pizarro and Almagro. An Englishman, Cecil Prodgers, the son of a Wiltshire landowner, secured an old Spanish document which directed him to go to

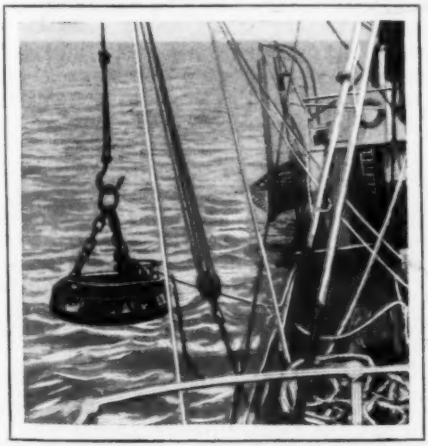
Top, Sand Sucker Which Helps Uncover Treasure Wrecks; Center, Radio Locator Which Detects Buried Metals; Bottom, Underwater, 20,000-Candlepower Lamp Used on Salvage Ships

the hill of the Caballo Cunco, near the river Sacamhaja, or Sacambaja. When he dug into the hill he found a faded, yellow parchment on which was written in Spanish: "You who dig here withdraw! The spot is dedicated to the Lord, and who dares enter shall meet with an agonizing death in this world, and eternal punishment in the next. The riches hidden here belong to our Master and are not for men."

All around the walls surrounding the cache, and on the entrances, a compound of strychnine had been spread. The poison is said to be derived from a bean found growing locally in the forests on the slopes of the Andes. Trying to force his way into the hill, Prodgers was poisoned and had to spend a year recuperating in an English watering place.

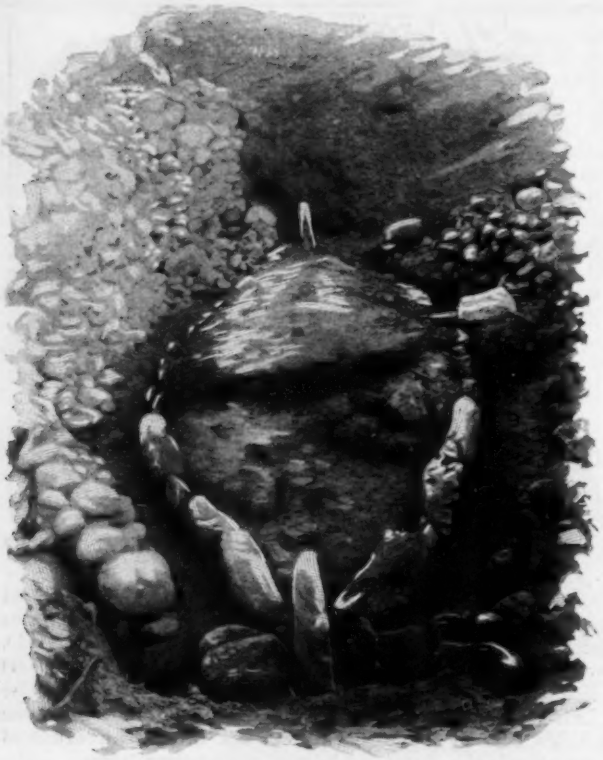
Buccaneer's Map of Sunken Treasure Ships in the Spanish Main Which the Pirate Presented to King Charles II of England

Modern bullion salvors might do well to turn to the other side of Latin America where, off Cape Frio, 100 miles east of Rio de Janeiro, lies the wreck of the British forty-six-gun frigate "Thetis," freighted with $810,000 in bags of gold and silver, the property of merchants afraid of the numerous and bloodthirsty pirates who swarmed the seas in the year 1830. Treasure to the value of about $270,000 in bullion and specie still remains to be fished up from this old wreck by some up-to-date deep-sea diver with armored suit, grabs, and underwater lamps.



Electromagnet Able to Raise Many Tons, Employed in the Salvaging of Sunken Treasure Ships

Among the dangerous coral reefs and cays, or hidden in the dense mangrove thickets on the shores of the West India islands, many treasure caches and galleon wrecks are still waiting for the modern hunters and salvors. In 1597, a Spanish galleon, the "Santa Margherita," crashed against a range of reefs and went to the bottom with some $6,250,000 worth of silver aboard. Four hundred years later, a famous American diver, Layman, was repairing a cable between Santo Domingo and the Bahamas, when he blundered straight into the rotting hulk with the treasure still intact. Layman marked the spot and later bought a yacht used by Sir Thomas Lipton in the well-known contest for the American cup. He sailed for the treasure, reached the ancient wreck and was then smashed up by one of those three-day hurricanes which are the curse of salvors in these reef-sown waters. His yacht became a derelict. A passing steamer



Viking Ship Propelled by Banks of Oars Which Was Found Buried in a Mound on the West Coast of Sweden Recently

rescued Layman who was forced to give up the quest. There are hundreds of such wrecks on the Bahama reefs and around Haiti and Santo Domingo.

Many of the old castles and ruined abbeys of England and Scotland still keep the secrets of old-time treasure hoards never found, though often sought. Peel castle, handed over by King George of England to the people of the Isle of Man, 700 years ago was the fort and dungeon of a Danish pirate chief, named Orry, who is known to have raided and robbed ships and seaside towns. Traditions, handed down for generations in the little Manx town of Peel, say that great hoards were hidden by his pirates in the precincts of the castle. Gold and silver coins have been dug up in and near the ruins of the old haunted castle, which stands on an islet rock, connected with the mainland by a causeway. A few months ago, the Peel town commissioners read a letter from a Mr. Price, of Australia, describing passages in the ruins in which he said explorers will find hidden treasure. The authorities are now thinking of exploring these ruins and the labyrinth of subterranean passages.

Submarine treasure alleged to lie in the rotting timbers of the galleons in the sound of Tobermory, Scotland, lured two British members of parliament, in 1929, to join the numerous seekers after hidden wealth. The Duke of Argyll owns the rights in the old wreck, which is supposed to have gone to the bottom with treasure worth about $10,000,000. Although divers have made many descents, they found that silt and mud had been so heaped up by the tides and currents in the sound that it was for the time impossible to locate the wreck.

The English salvage firm, Siebe, Gorman, of London, has a museum in which is to be seen a Spanish treasure chest recovered from the wreck of the steamship "Alphonse XII." The chest is one of seven which held gold coins worth $50,000, and one of the coins is set in a glass panel fixed outside the chest. Next to the coffer is exhibited a silver dish, spoon and gold ring raised by divers from the wreck of the British warship "Royal George," which was blown up near Portsmouth, in 1782. Many relics taken from the old Spanish galleon in Tobermory sound are in this museum.

Modern Americans, in 1928, were hunting around lone Mount Nebo, Palestine, to find the solitary hollow cavern where Jeremiah, the prophet, hid the sacerdotal treasures, including the Ark of the Cove-

nant, the golden altar, the wooden chest lined with pure gold and adorned with golden cherubim. Nebuchadnezzar and the hosts of Babylon were advancing on Jerusalem, when the prophet announced in stern tones "that place [the hiding place of treasure] shall not be known until the time that God gather his people together and receive them unto mercy." An adventurer from Los Angeles recently climbed for the first time by automobile up Mount Nebo, the Palestine government having given him permission to explore the mountain for the hidden cave of the golden ark. He returned to America,

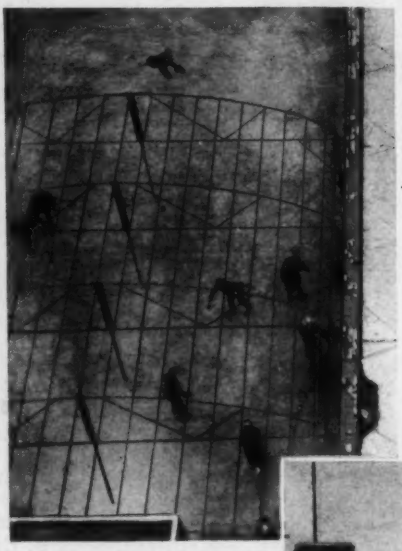
Top, Attacking Bullion Room of Sunken Ship with Oxyhydrogen Blowpipe; Below, Pumping Out a Wreck in the Search for Riches

where he is now said to be arranging for another expedition to make a more exhaustive search around the mountain. Many treasure hunters have sought for these temple hoards, but without success.

All the latest and most scientific deep-sea diving apparatus, ocean lamps, electric grabs and magnets have been unable to break from Davy Jones' locker the ten or twelve million dollars worth of bullion and specie lying in the strong rooms of the sunken British P. and O. liner "Egypt," at the bottom of the sea, off Ushant, France. For six years the search has been going forward. Now, however, divers, who have raised some of the treasure from the sunken liner "Laurentic," torpedoed during the European war, believe that, with a new and improved water digger, they will eventually enter the strong rooms of the "Egypt."

Modern treasure-wreck salvors may like to hear that the richest of all treasure wrecks lies unconquered just outside Vigo bay, Spain. Among the logs of British men of war, which the writer has examined at the London Public Record office, is that of the "Monmouth," which captured a Vigo galleon with immense treasure aboard. The galleon ran on a submerged rock pinnacle, and went to the bottom of the sea off the south end of the isle of Bayona, near Vigo. Several modern expeditions, whose projectors have never seen the evidence of these documents, have searched the wrong location. The right place, as Doctor Iberti, a previous salvor and historian, has pointed out, is that marked on modern nautical charts as "Los Castros de Agoeiro," to the northwest of which, about half a mile distant, lies the wreck of this richest of the galleons of the Spanish fleet, bound for Vigo bay.

SKATING ON SKYSCRAPER ROOF LATEST WINTER SPORT



Looking Down on the Skyscraper Skating Rink from a Higher Level, and a Corner of the "Pond," Showing the Lofty Location among Near-By Towers

Skating on the skyline is enjoyed by members of the Tavern club and others who flood a portion of the roof of a Chicago skyscraper in cold weather. The area, used for dining and dancing in the summer, is quickly transformed into a large rink that may be lighted at night and will accommodate a considerable crowd. Tenants of this and adjacent buildings thus are afforded a healthful way to spend part of their noon hour or other leisure time.

LIMIT TO THE SIZE OF PLANES IS SET BY WEIGHT

Whether commercial aviation in the future will depend mainly on airplanes or airships remains to be seen, but for carrying heavy loads at moderate speed the lighter-than-air craft, considering materials and designs as now known, has decided advantages. The chief factor is that its usefulness as a load carrier increases with increased size, while this is not so true of the airplane. Engineers have declared that eleven pounds per horsepower appears to be the maximum useful load of a flying boat, but a superairship still shows an increasing efficiency with a useful load of seventy-four pounds per horsepower. Experts of the Detroit Aircraft corporation, who supervised the construction of the all-metal "ZMC-2" for the United States navy, report that "airplanes of a gross lift of twenty to twenty-five tons and flying boats of a gross lift of fifty to sixty tons mark the limit beyond which any increase in size would not be profitable." In an airship, the useful load per horsepower increases rapidly with volume, but in an airplane, the useful load per horsepower is about constant, showing little increase with size and, in extremely large craft, actually decreasing. For these and other reasons, engineers are looking to the airship to solve the problem of extensive oceanic air traffic.

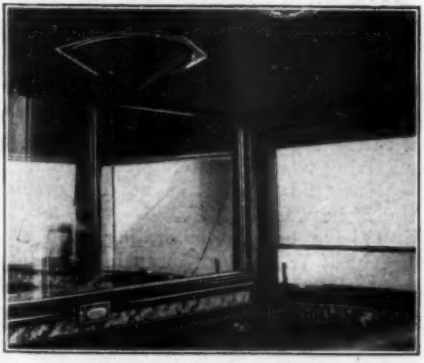
¶Whenever you find that you wish to know more about any article that is described in this magazine, write our Bureau of Information.

BEAM OF LIGHT STOPS TRAIN WHEN SIGNAL SHOWS

Using a flashing beam of light, reflected back to a locomotive from mirrors on signal posts, to stop trains automatically, is being tried out in Germany with success. From a small searchlight on the front of the engine the narrow beam of light is thrown upward. Around the searchlight lens is a ring of light-sensitive cells, the mirror on the signal post reflecting the beam back to one of these cells. This starts an electric current which makes a visible signal in the engine cab. If the engineer does not respond promptly to this signal, the train is stopped automatically. Movement of the mirror on the post determines which cell receives the reflected light, each cell giving a definite signal to the engineer. With this system all the complicated apparatus is on the locomotive where it can be adjusted and repaired in the roundhouse instead of along the right of way, as has been the case with other electrical-signal systems for the same purpose.

MUSICAL TAXIS FURNISH TUNES TO ORDER OF PASSENGERS

Parisian taxicabs have enabled passengers to play as they ride by installing radio loud speakers in the roofs. When a fare enters a taxi, the first polite query of the driver concerns the type of music preferred, after which the set is tuned to one of the broadcasting stations selected by the passenger.



Paris Taxicab, Showing Radio Loud Speaker in Roof Which Furnishes Music for Passengers

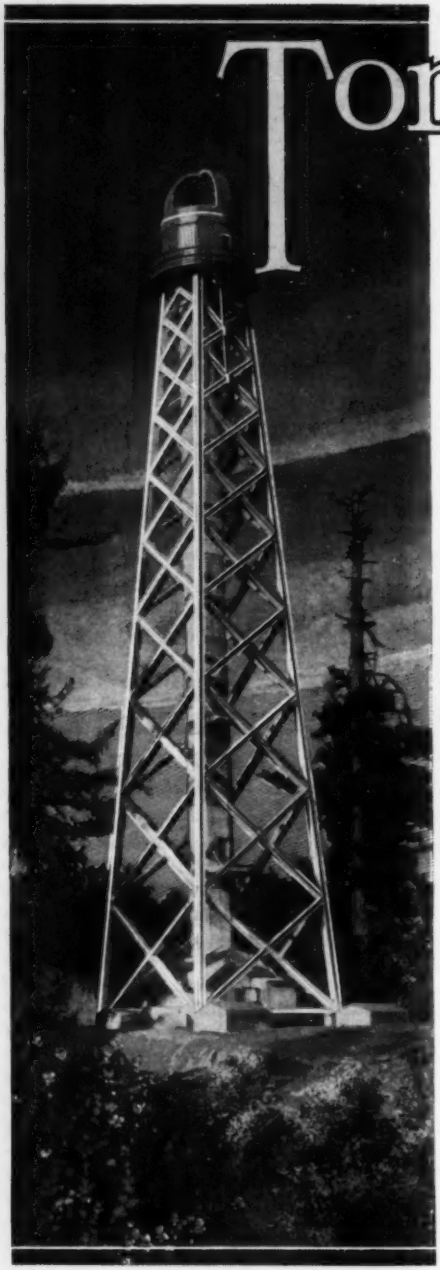
Torsion Grips and Automatic Gravity Clamps Protect Workmen on This Scaffold from Accident

SCAFFOLD HAS SAFETY LOCKS WORKING AUTOMATICALLY

Equipped with three separate safety attachments that operate automatically, a scaffold now is available which is virtually accident-proof. Workmen wear belts by which they are attached by torsion grips to a trolley, suspended between the ropes of the scaffold and secured independently to the building. Thus they can move about freely but are automatically attached to the trolley if the ropes break or they should slip. A gravity clamp permits the ropes to slide through the pulleys but closes on them if one breaks or a knot slips loose, the scaffold locking itself after falling a few feet. A steel anchorage for hanging the scaffold from the roof consists of two steel cables with hook terminals, a chimney-corner clip at one end and a torsion grip at the other.

¶Palestine is slightly larger than the state of Vermont.

Tornadoes



The 150-Foot Tower Telescope at Mount Wilson Observatory, Used Exclusively in Solar Research

By GEORGE W. GRAY

A BLIZZARD was sweeping the continent from the Rockies to the Atlantic one day last fall. The freeze reached as far south as Jacksonville and Dallas. Even Mexico City was touched by the cold wave which rode in there on a hailstorm.

While millions of surprised people all over America shivered through this cold snap, a few men here and there were quietly watching another outburst 93,000,000 miles away—for it chanced that storms were raging on the sun.

The most prodigious of these solar disturbances could be seen clearly through a smoked glass; it looked like a black moth that had alighted squarely on the nose of Old Sol. But a moth of such dimensions could swallow the earth and gulp down the moon as dessert, for the astronomers' measurements showed its diameter to be not less than 40,000 miles—and the earth's broadest diameter is less than 8,000 miles. Though by far the largest, it was but one of a flock of spots that strung along the face of the sun for 700,000 miles.

This sunspot procession is remarkable not only for its size and numbers, but also for the fact that it was predicted. Dr. Harlan True Stetson, then of Harvard, announced in December, 1928, that an unusual outburst of solar activity should be expected in October or November, 1929. Doctor Stetson recently became director of the Perkins observatory at Delaware, Ohio, where he is continuing his studies with the aid of the great sixty-nine-inch reflecting telescope lately erected there.

"How did you arrive at this prediction?" he was asked.

"I have been collaborating with Dr. Greenleaf W. Pickard in an investigation of possible relations between the sun and radio communication," answered the astronomer. "We found that about every fifteen months radio reception became noticeably poorer. In every instance this

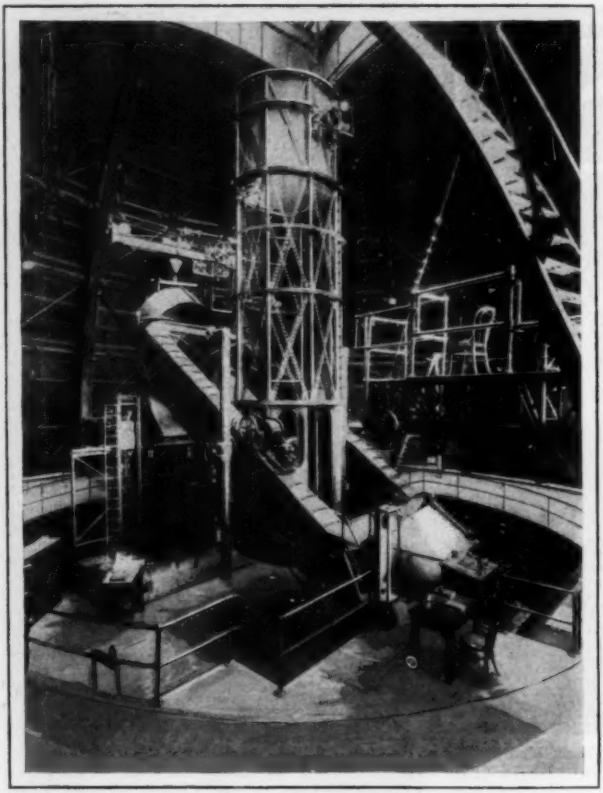
A Solar Prominence, 80,000 Miles High, Photographed at the Mount Wilson Observatory; the Huge Flames of Hydrogen Gas Shown Are Associated with Sunspots by Scientists

marked disturbance in the earth's atmosphere was matched by the appearance of spots on the sun.

"It has been known for nearly a century that sunspots wax and wane in cycles. There comes a year when the sun seems to calm down; its face is unmarked for days and weeks on a stretch. Then spots begin to appear, increase in number, and generally in size too. Finally a time is reached when they are within five degrees of the solar equator, and it is usually at this time that the largest spots appear and the greatest number are visible at the same time. When this peak arrives we are at sunspot maximum. Thereafter, spots diminish in size and number until finally they disappear and we are at sunspot minimum. The time from one minimum to the next varies, but on the average it is a little more than eleven years. Now, what Doctor Pickard and I have observed is that within this well-known eleven-year cycle the sun seems to pulse at intervals of about fifteen months.

"I have looked back in sunspot records for many years, and find again and again recurrence of this period. With such data, it seemed reasonable to expect another solar outburst about fifteen months following that of July, 1928. So I felt complete confidence in predicting one for the fall of 1929.

"We may look for a new outbreak of spottedness around February, 1931," added Doctor Stetson, venturing another forecast, "though I don't expect it to equal the procession of last November. We are surely past sunspot maximum now, and can look forward to a minimum about 1934. When minimum is attained, radio reception should be the best we have had in many years."



Nebulæ, Believed to be 840 Million Million Million Miles from the Earth, Have Been Seen through This 100-Inch Hooker Telescope

What are these mysterious spots that can reach across 93,000,000 miles of interplanetary space to distress and mock our new-found mastery of the ether?

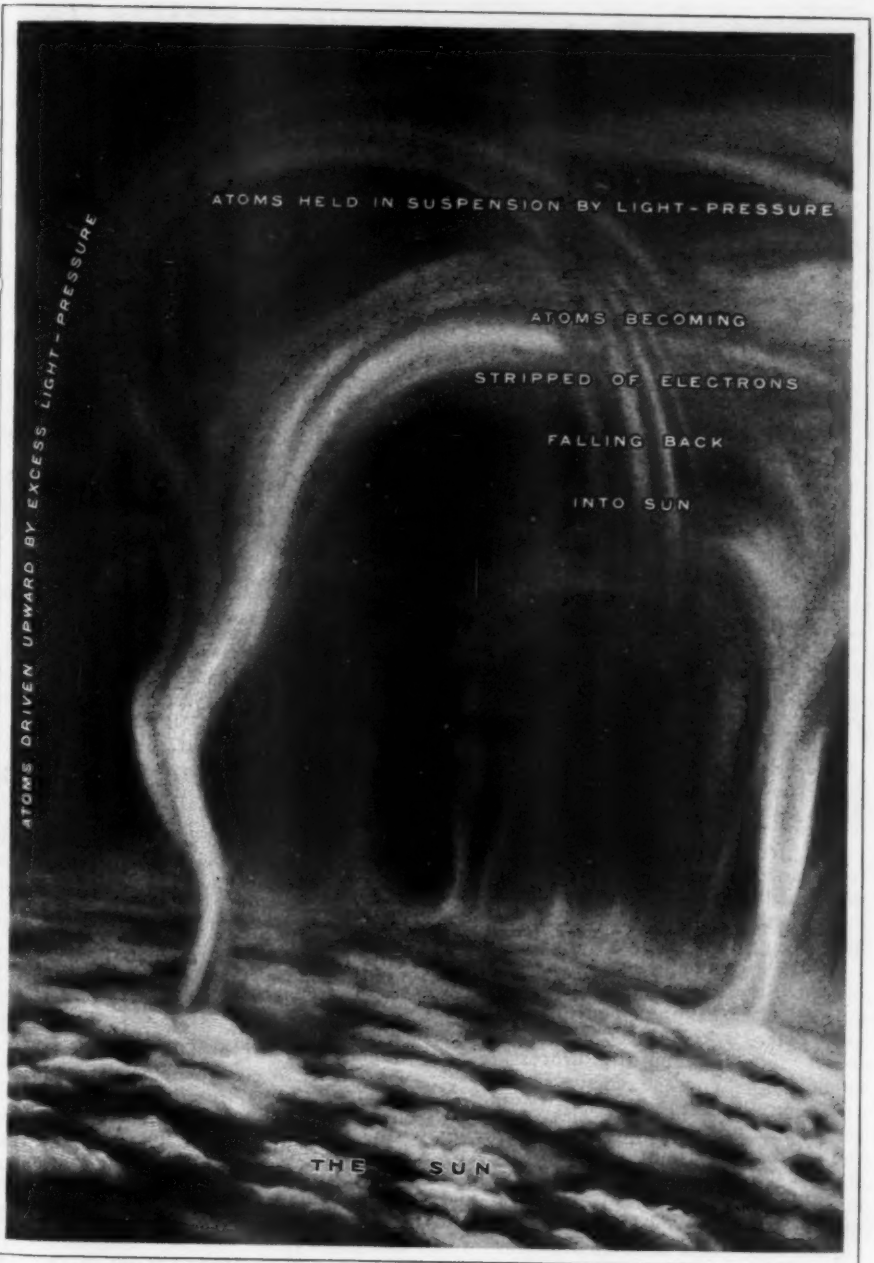
Tornadoes, say the astronomers—great eruptive whirls of hot glowing gas, each a spiraling funnel moving at incredible velocity, spurting up clouds of hydrogen and calcium and other elements, sucking the fiery vapors back into its capacious crater where atoms are smashed, stripped, excited into intense radiation, and bombarded into space.

Thus each sunspot becomes in effect a gigantic cathode-ray tube shooting a beam of electrons. The collision of these high-speed sun particles with the atoms of our upper air is believed to be responsible for the radio difficulties which recur with increase of sunspots.

Dr. George Ellery Hale, of Mt. Wilson observatory, is largely responsible for our present knowledge of sunspots. He found that the spots are not only tornadoes but are huge magnets. In many cases they occur in pairs, one spot being positively magnetized and the other negatively. Working with more powerful instruments, he discovered unsuspected areas of magnetic activity where no dark markings were visible, and in this way located hidden sunspots.

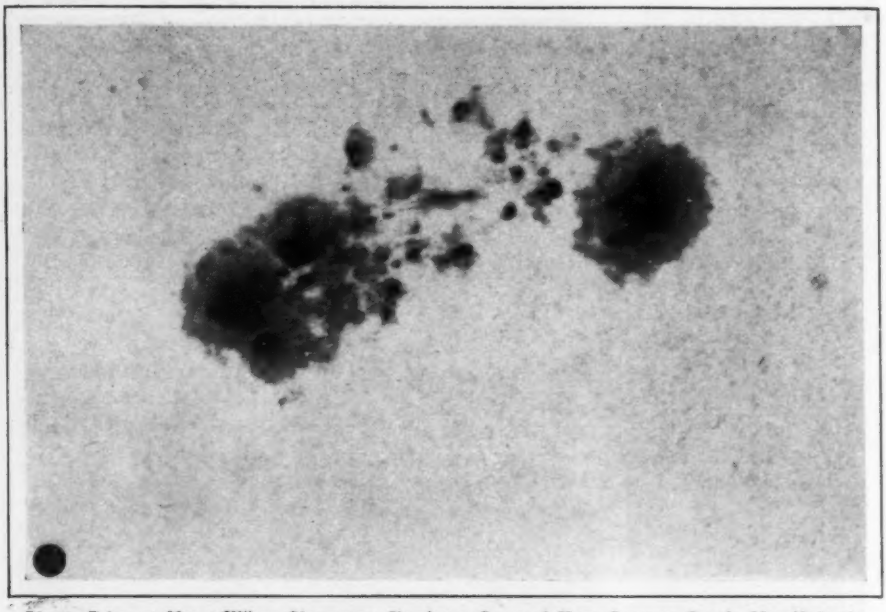
In addition to atmospheric agitations which trouble radio communication, strange currents of electricity are set up in the earth. These get into grounded telegraph and telephone lines and cause more trouble. Thus in May, 1921, when two large spots approached the sun's equator, a terrific magnetic storm raged over the earth, and wild electrical currents interrupted telephone and telegraph service over a wide area of the United States. These untamed currents punctured the insulation of cables, burnt out fuses and operated other protective devices, set fire to a telephone switchboard at Philadelphia and to a railroad signal station at Brewster, N. Y., and are charged with responsibility for the fire which destroyed the union railway station in Albany, N. Y., and a telephone exchange in Karlstad, Sweden.

Dr. Charles G. Abbot and his associates, of the Smithsonian Institution, by investigations extending over many years, have found that the sun's temperature rises with increase of spots. Strangely enough, the earth seems to be a little cooler than average when spots are numerous, and slightly warmer when spots are few or absent.



© The Illustrated London News

This Wraithlike Picture of the Sun Shows Clouds of Atoms Kept in Suspension between the "Push" of Light and "Pull" of Gravity, Until They Lose Their Electrons and Fall Back



Picture Taken at Mount Wilson Observatory Showing a Group of Huge Sunspots Greatly Magnified; the Round Spot, Lower Left, Shows the Size of the Earth on the Same Scale

Does this mean that sunspots affect our temperature; that the earth's weather is determined by the sun's weather?

Nobody knows. The great atmospheric machine which produces and delivers our weather is so complicated—so affected by polar ice fields, tropic seas, and other diverse surface conditions—that its direct response to solar changes cannot be traced unmistakably. It may be remarked, however, that many interesting coincidences have been noticed.

Recall, for example, that the cold wave of last November came just as a giant sunspot was nearing the center of the sun's face, and that, during the two weeks following, as the procession of spots was passing around the sun's western hemisphere, the North Atlantic was torn by tempests of hurricane violence, the coasts of Britain were strewn with shipwrecks, a waterspout destroyed a church and many homes in Portugal, and in Spain, France and England rains were violent and rivers inundated.

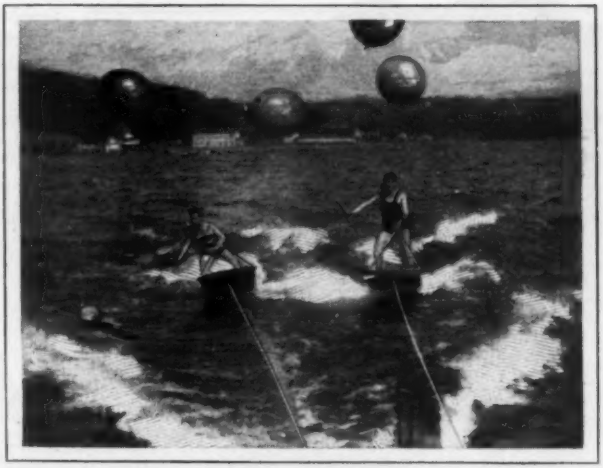
Mr. H. H. Clayton, formerly head of the Argentine government's meteorological service, who has made a life study of world weather, states his opinion that our queer weather of last fall was attributable to sunspots.

OIL ELECTROPLATES SURFACE WHICH IT LUBRICATES

Oil which electroplates the surface it lubricates, thus preventing corrosion and wear, has been developed recently and used successfully for the gear box and rear axle of automobiles with a probability that it also may be adapted for the engine itself. The lubricant was developed as a result of an inquiry into corrosion in roller-bearing steel friction wheels employed in a transmission. The trouble was traced to electrochemical action. To reverse this electrolytic action, a lubricant was formed of a mixture of zinc oxide and mineral oil. Tests showed that this oil not only stopped corrosion, but actually plated working surfaces with a thin coat of zinc. This adheres strongly, but there is no risk of changing the dimensions of the parts, as no further deposit occurs after a thickness of less than .02 millimeter is reached.

"NOISY" OYSTERS HEARD BY SHIPS

Noise of oysters, it has been found, is interfering with ships' "ears"—the microphones suspended below the surface as an aid in figuring depths and guiding the vessels. When the oysters open and close their shells, the highly sensitive apparatus picks up the noise and transmits it to the ship. The microphones used on ships are so sensitive that they have broadcast the beat of the human heart and the noise of insects eating in a corn crib, so that a closing oyster shell makes a great racket in comparison. Any decrease in sensitivity, however, would impair the usefulness of the apparatus.



Surfboard Riders Enjoying a "Balloon Busting" Contest; They Attempt to Puncture the Balloons with Pin-Tipped Bamboo Poles

SURFBOARD RIDERS PUNCTURE BALLOONS IN WATER GAME

Not content with the mere thrill of clinging to a swaying surfboard towed by a speeding motorboat, some of the devotees of this exciting sport have organized a game called "balloon busting." The rider is equipped with a pin-tipped bamboo pole, some six feet long. One person drives the boat, another sits in the rear and releases inflated balloons, and the rider attempts to puncture each one released with the lance.

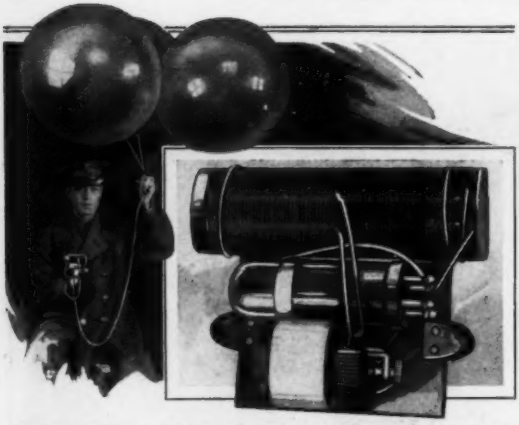
CLOCK COMBINED WITH AERIAL FOR THE RADIO SET

Containing an inside radio aerial in its base, a clock now is on the market which serves the dual purpose of timepiece and means of concealing unsightly inside wires. It is equipped with connections for light wires and terminals for hooking up with the radio, and operates on alternating or direct current. The clock itself is not electrically operated, but contains a multi-zone dial, giving the time in each of the twelve zones of the world, thus making it easy to pick up a radio program anywhere without computing difference in time.

¶Tungsten carbide is hard enough to scratch sapphire.

FOUNTAIN MOISTENER FOR DESK REPLACES SPONGE

Replacing the sponge and water-filled dish as a moistener for the desk, a handy fountain implement now is available. It consists of a handle on the end of which is a wide sponge tip. A rubber holder containing water keeps the moistener upright and in condition when not in use, and a valve prevents leakage.



Three Balloons to Which Are Attached Radio Instruments for Recording Weather Conditions, and Recording Apparatus

WEATHER BALLOONS SEND OUT REPORTS BY RADIO

Radio-equipped balloons that automatically report atmospheric conditions encountered in free flights recently have been used in Russia and France. The Russian instrument carries a light meteorograph with indicating arms for barometric pressure, temperature and relative humidity. The ends of the arms are spaced about a disk, on which is mounted a contact point turned by clockwork once a minute. A battery and spark gap announce the contacts made by this point with the ends of the arms. At the receiving instrument a record of the contacts is traced on a revolving cylinder by apparatus similar to that used for receiving weather maps broadcast by radio. The French device sends out radio signals at regular intervals showing barometric pressure and temperature encountered by the balloon. These are received both as audible signals and by a recording pen. In this instrument a make-and-break device is used to indicate barometer and thermometer readings by the duration of the signals. A radio pilot balloon, developed by the U. S. signal corps, indicates the speed and direction of the upper winds. A small radio transmitter is sent aloft attached to three hydrogen-filled balloons. At various ground stations the direction from which signals come is determined by apparatus such as is used with the radio compass, and reported to a central point where the movements are worked out and plotted.

PIE PAN THAT DOES NOT SPILL JUICE

Pie pans that do not allow juice to spill over the edges onto the oven floor are equipped with a trough around the outer rim where all the excess liquid is caught during baking. This upper rim also prevents the bubbling juice from dripping back into the pan itself, thus keeping the pies from sticking.

SNOW TOSSED FROM ROADWAY BY ROTARY PLOW

Rotary snowplows that tossed the snow in a cascade from fifty to one-hundred feet from the roadway were employed in keeping Chicago streets and boulevards clean during heavy winter storms. The plows were pushed by trucks and gathered the snow into a conveyor which shot it out at the side like a great waterfall.

Rotary Plow That Eats Up a Snow Bank at Twenty Miles an Hour, Picking Up the Snow and Tossing It Far beyond the Curbing

Looking Down on Kelly Field, the Advanced Flying School of the United States Army Air Corps at San Antonio, Tex., Where Flying Cadets Complete Their Year's Course

FLYING instruction, second to none in the world, is offered by the United States army air corps at its three main schools, Kelly and Brooks fields, near San Antonio, Tex., and March field, at Riverside, Calif. The last two are known as the primary schools where the students, flying cadets, receive rigorous training in all maneuvers necessary to pilot an airplane, besides work on airplane engines, navigation, machine guns, radio and other subjects necessary for a military pilot.

For a month at either of the primary schools, the cadet is dubbed a "Dodo," for he is more or less on probation, and the fact that approximately fifty per cent of the men who enter the training schools are eliminated, or "washed out," before they reach the advanced stage of the year of instruction, the last four months at Kelly field, is evidence of the thoroughness of the work and the high standards required to complete it.

After a successful month, the Dodo disappears and in his stead a full-fledged cadet emerges who is rapidly advancing in the intricate tasks of flying with an instructor, solving ground-school problems and absorbing military drill and discipline.

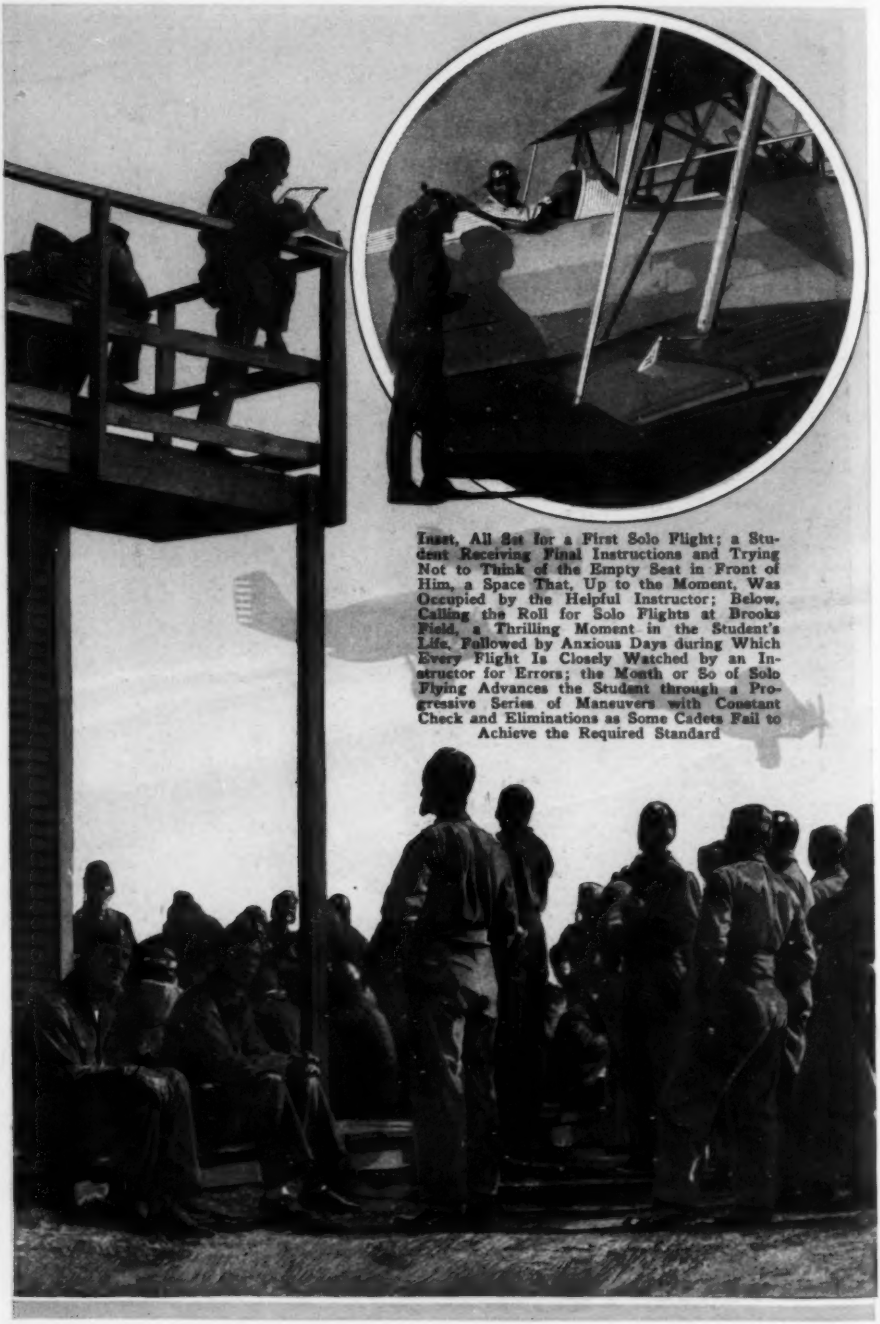
Four months of primary work, and the cadet enters on the second and last stage of his training preliminary to the advanced school at Kelly field. Here he pilots regulation service-type airplanes instead of the training ships, takes part in cross-country flying, receives thorough instruction in aerial gunnery and special work in either pursuit, attack, bombardment or observation aviation. Once admitted to the final stages of training here, the cadet is almost certain to finish unless he is dismissed for some infraction of regulations, and receive the coveted "wings," the insigne of an army pilot.

Air-corps cadets are recruited from the enlisted ranks of the regular army, from members of the national-guard air corps, members or graduates of R. O. T. C. units and from civilian life. Candidates must be unmarried male citizens of the United States between the ages of twenty and twenty-seven, must have had the equivalent of two years of college, must be of excellent character and in sound physical condition.

(To Be Continued Next Month)

Learning, and Laughing a Bit Too, While Waiting Their Turn in the Air; Students at the Advanced Flying School Receiving Pointers from an Instructor and Watching Their Fellows Fly

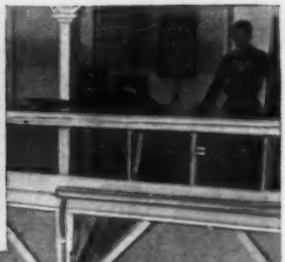
A Three-Man Jump at Brooks Field; a Remarkable Photograph Showing Three Stages of the Drop; the Man at the Top Has Just Left the Plane; the Next Lower Is Pulling the Cord, and the Chute of the Third Is Unfolding; at Bottom, the Way Parachute Jumping Is Taught at Brooks Field, the Primary Training School; the Jumper Dives Head First, but Before He Leaps, He Must Have His Hand on the Ring

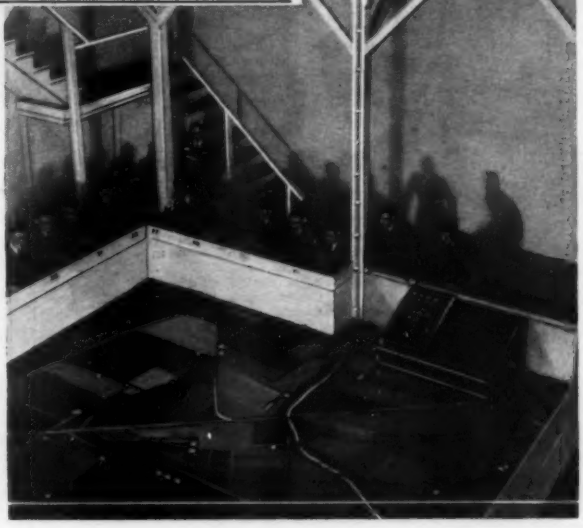


Inset, All Set for a First Solo Flight; a Student Receiving Final Instructions and Trying Not to Think of the Empty Seat in Front of Him, a Space That, Up to the Moment, Was Occupied by the Helpful Instructor; Below, Calling the Roll for Solo Flights at Brooks Field, a Thrilling Moment in the Student's Life, Followed by Anxious Days during Which Every Flight Is Closely Watched by an Instructor for Errors; the Month or So of Solo Flying Advances the Student through a Progressive Series of Maneuvers with Constant Check and Eliminations as Some Cadets Fail to Achieve the Required Standard

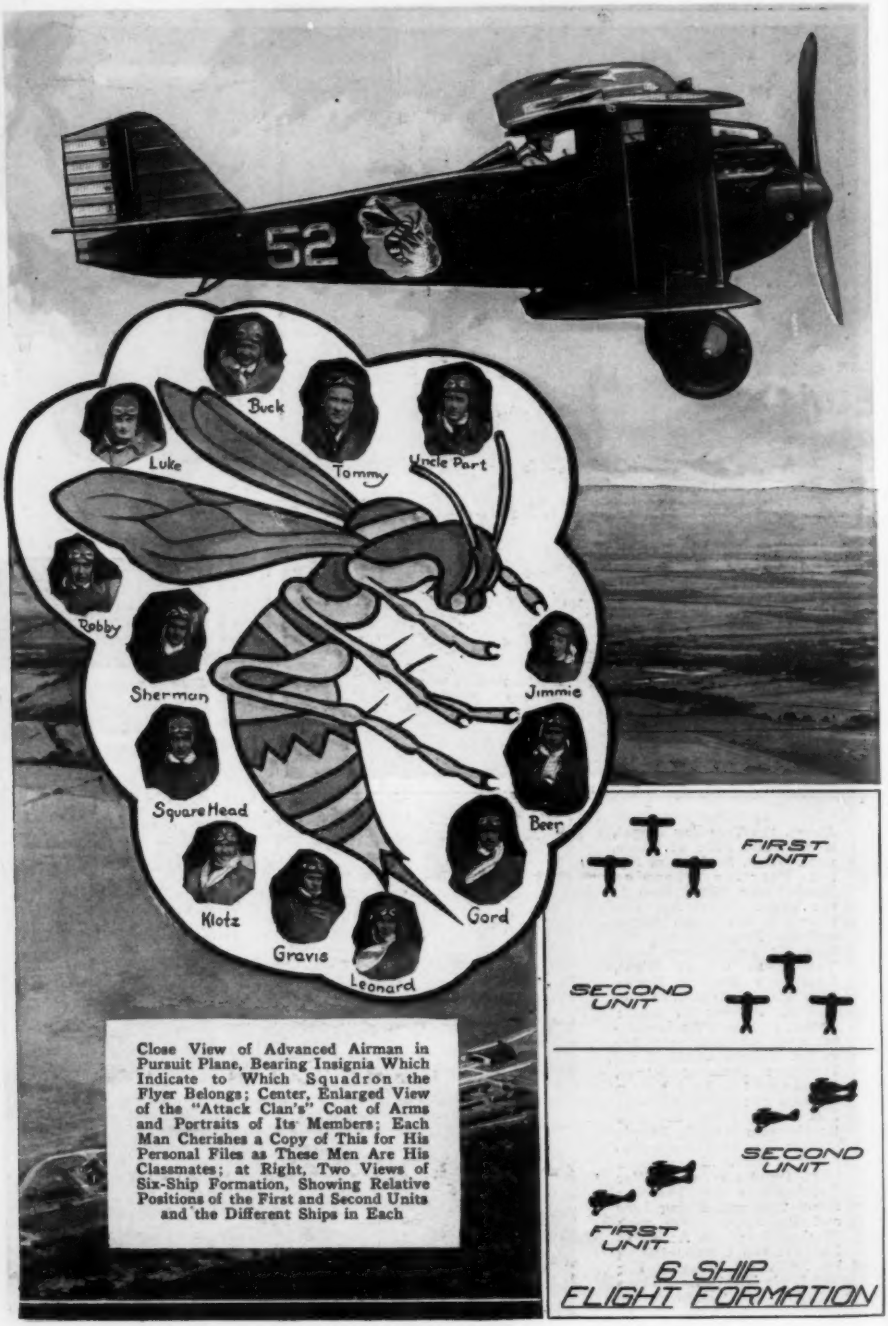
Kelly Field Polo Team; Superbly Drilled, Skillful and Always Ready for Battle with Other Army Units; Below, Major General Hines Speaking at Graduation Exercises; upon the Successful Completion of the Course, the Flying Cadet is Discharged from the Service with the Rating of Airplane Pilot and Receives the Coveted "Wings," a Commission as Second Lieutenant in the Reserve, or Accepts Active Duty

Growing Wings for the Machine-Gun Units; in Upper Photograph, Three Gunners Are Leaving Their Planes; a Ship Following Them Drops the Gun, Attached to a Parachute from an Altitude of About 200 Feet; It Is Inclosed in a Heavy Bag, but Is Quickly Unpacked and Made Ready for Firing as Shown Below; This Maneuver Illustrates How Strategic Positions, Especially behind the Enemy's Lines, Can Be Seized Quickly in Case of Actual Battle

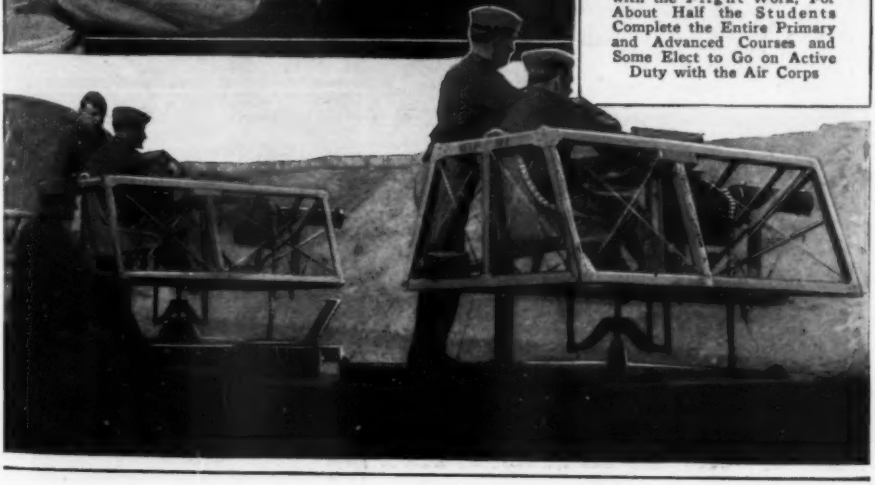




Above, the Traveling Carpet, a Miniature Field of Battle, upon Which Students of Flying Practice Dropping Bombs; the Three Men in the Upper Center Are Stationed at the Bomb Sights and the Instructor and His Men Sit Immediately below Them; at Upper Right, Loading a Practice Bomb; This Shows the Fourth Operation, Pouring in Sand; Below, at Right, the Instructor and His Assistants Are at the Control Board of the Miniature Bombing Range, Regulating the Shell Flashes on the Model Landscape; Instruction Such as This Supplements Pursuit, Attack, Observation and Bombardment Flying, Maneuvers That Duplicate Actual War Requirements and Include Night Missions, Flying Low and Raking an Area with Machine-Gun Fire, Acting as Lookout and Communicating by Radio or Dropping Big and Little Bombs from Huge "NB's" and "Keystones"

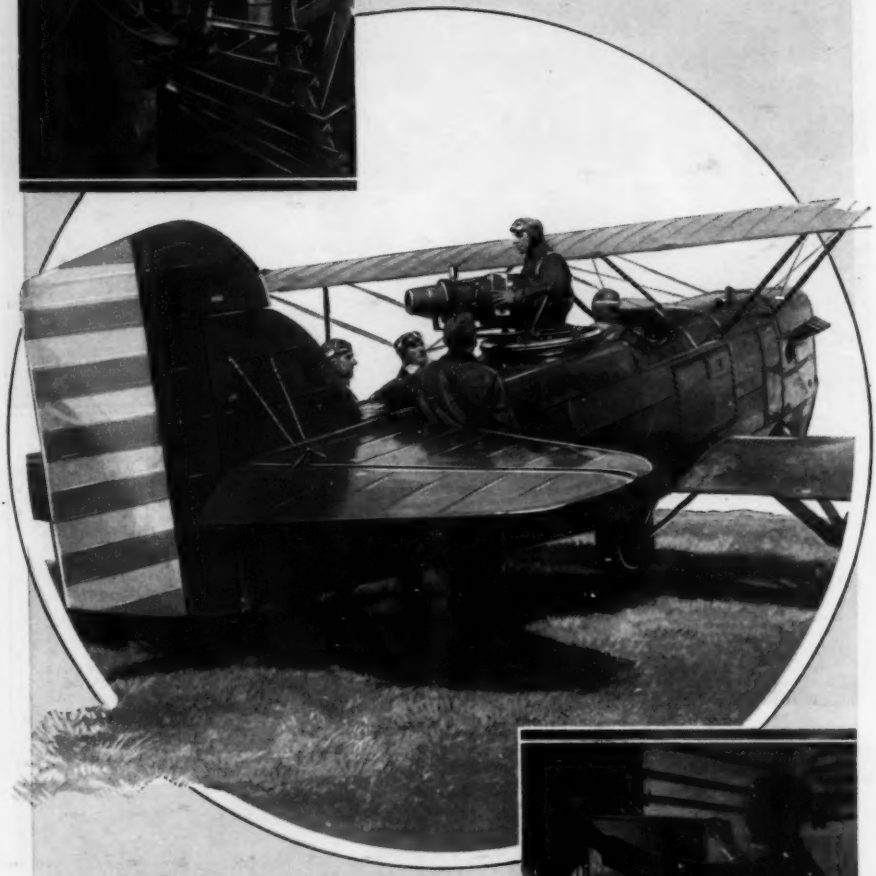


Close View of Advanced Airman in Pursuit Plane, Bearing Insignia Which Indicate to Which Squadron the Flyer Belongs; Center, Enlarged View of the "Attack Clan's" Coat of Arms and Portraits of Its Members; Each Man Cherishes a Copy of This for His Personal Files as These Men Are His Classmates; at Right, Two Views of Six-Ship Formation, Showing Relative Positions of the First and Second Units and the Different Ships in Each

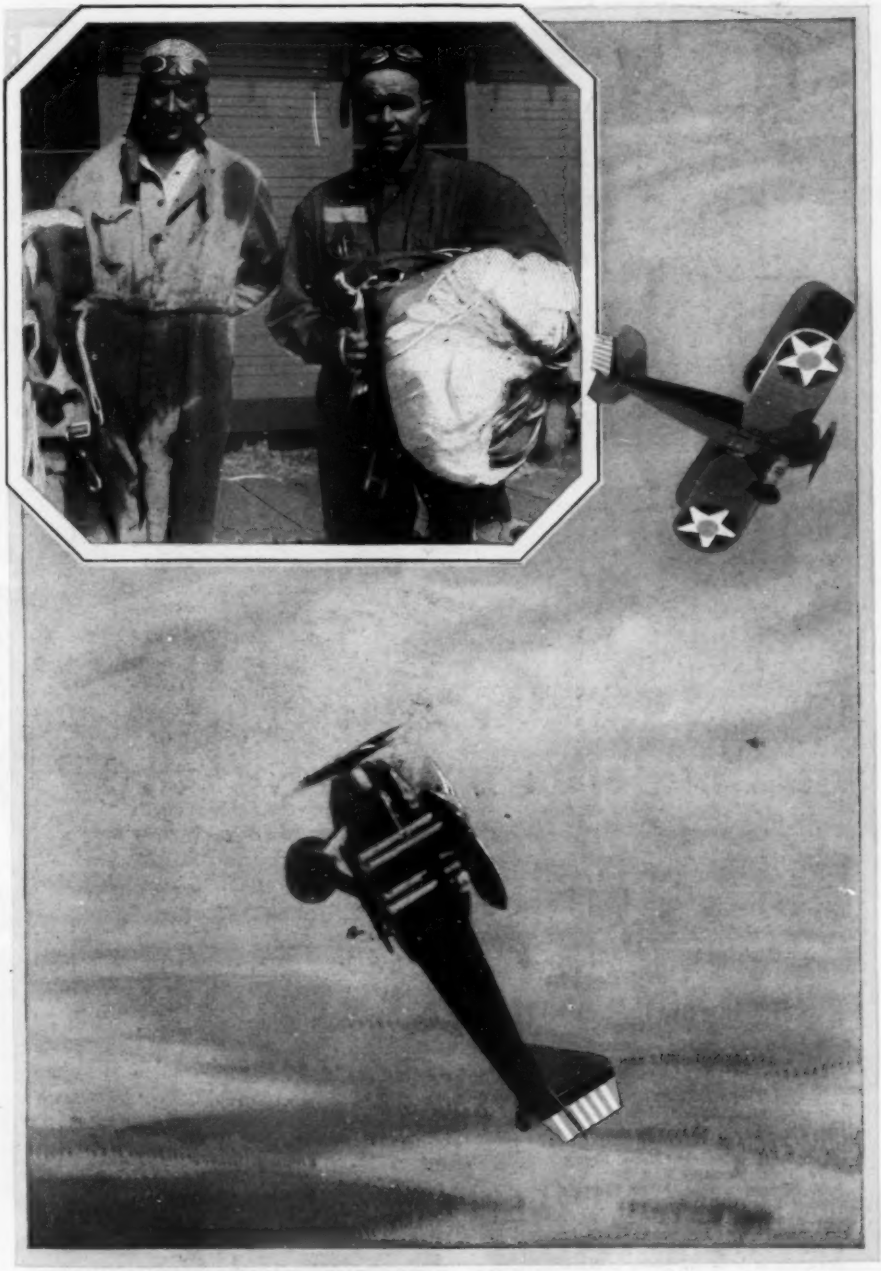


Cadets Receiving Motor Instruction, and, Below, at the Machine-Gun Range; Special Attention Is Paid to These Marksmanship Drills, and Results Are Carefully Checked to Determine the Cadet's Grade; as Seen, the Student Is Seated in a Balanced Cage, Which Can Be Moved to Simulate the Action of a Plane in Flight; Extensive Military Drill and Range Practice Are Given with the Flight Work, For About Half the Students Complete the Entire Primary and Advanced Courses and Some Elect to Go on Active Duty with the Air Corps

Big Reel for Drying Films Taken to Prepare a Mosaic Map; Extensive Work in Aerial Photography and All Its Stages Is Given Along with the Observation Training of a Flying Cadet



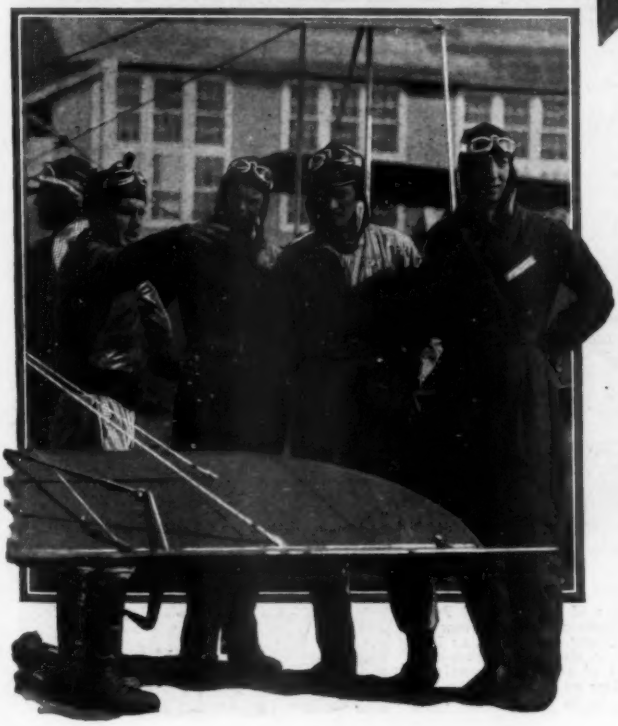
Aerial Camera on a Machine-Gun Mount in an Attack Plane with Part of the Class, and, at Right, Developing Large Negatives; Students Are Taught All the Processes of Photography in the Observation Section, from Taking Pictures While in the Air to Developing the Prints and Preparing Mosaic Maps; Learning to Control the Plane While Air Pictures Are Being Taken Is a Trick in Itself



Inset, after an Air Collision; Both of These Men Had Just Jumped Safely, Following a Mishap in Dog-Fighting, an Episode of Which Is Shown in Lower Photo

Top Photo, © Eastman Kodak Co.

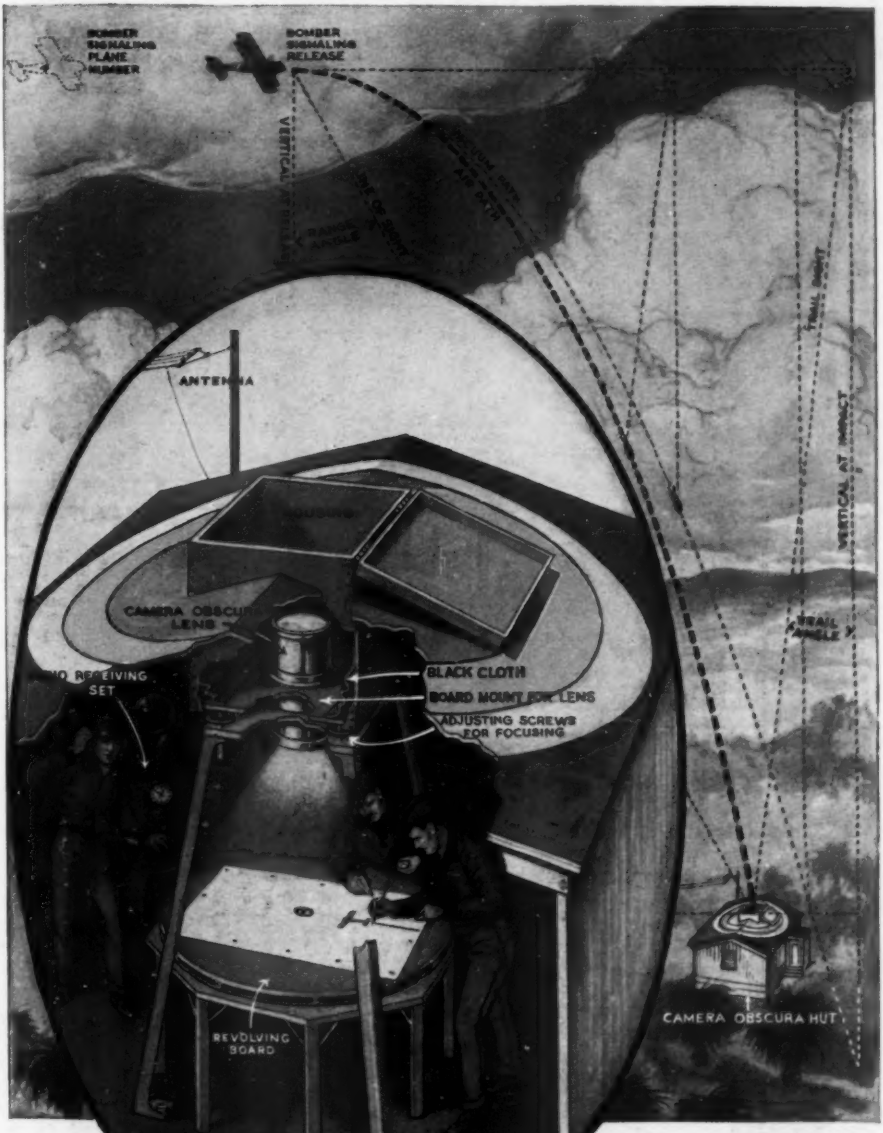
Inset, Rookies Now but Proud Flyers in a Few Months—May Be; Below, Inspection Day at the Primary Flying School, Brooks Field; Army Discipline with Its Rigorous Routine, Plays an Important Part in Molding the Flying Cadet, Although Standing at Attention Seems to Have No Direct Bearing on the Handling of the Controls of an Airplane



"Dodo" Boys, Primary Student Flyers, Drawing Helmets and Goggles, and, Below, Advanced Primary Students Receiving Instructions before a Flight; during These Early Days of His Course, the Future Pilot, So One Described It, Passes through a Routine Something like This: "Examinations, Drill, Drill, Examinations. Inspections from 6:00 A. M. to 10:00 P. M. One Bell after Another. No Time to Wash. Drill. Squads East and West. Double Time. To the Rear, March! Will You Ever Learn to Fly or Is It Just a Dream? Examinations. Three Times to the Orientator. More Bunk Flying. But Finally the Two Weeks Drag to a Close and You Draw Helmets and Goggles. Flying Starts Monday. Could It Be True and Would the Weather Be Fair?" On Monday the Cadet Meets His Instructor, Adjusts His Parachute and Has the Thrill of a First Ride with Fifteen Minutes of Joy and the Pleasure of the First Attempt at the Stick; the Plane Responds but in a Perplexing Way. So It Seems to the Candidate

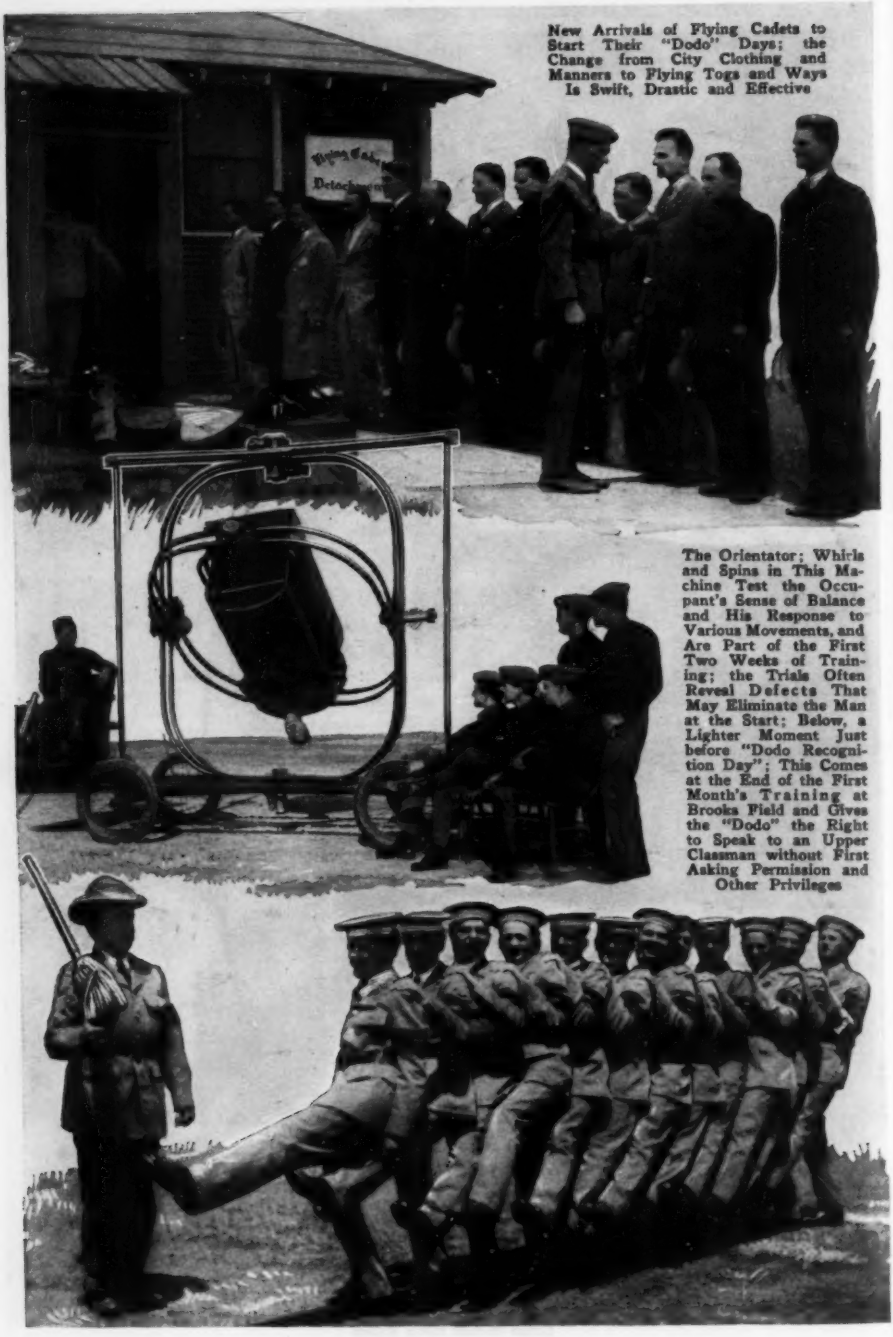
Instruction on Bombs and Bombing; Cadets Learn the Interior Construction of Bombs, How They Are Aimed and Released, and What They Probably Will Do When They Strike; All This Comes in Connection with the Flight Training in Big Bombing Planes and during Warlike Maneuvers

Inspection of Students and Personal Equipment at Advanced Flying School, and, Right, an Instructor at Kelly Field Showing Students of the Observation Class How an Aerial Camera Is to Be Mounted



Charting a Bomber's Target Performance by Means of the Camera Obscura and Radio Signals Sent from the Bombing Plane and Received in the Hut; the Shadow of the Plane Is Traced on the Revolving Board; the Bull's-Eye in the Center Is the Camera Hut

As the Bomber Approaches the Target, He Signals His Plane Number Which Is Received by Radio in the Hut; Next He Flashes "Release," and the Man in the Center Notes the Position of the Plane on the Paper; It Is Then Merely a Matter of Computing Altitude, Angles and Wind Conditions to Determine How Close to the Mark the Bomb Would Have Fallen



New Arrivals of Flying Cadets to Start Their "Dodo" Days; the Change from City Clothing and Manners to Flying Togs and Ways Is Swift, Drastic and Effective

The Orientator; Whirls and Spins in This Machine Test the Occupant's Sense of Balance and His Response to Various Movements, and Are Part of the First Two Weeks of Training; the Trials Often Reveal Defects That May Eliminate the Man at the Start; Below, a Lighter Moment Just before "Dodo Recognition Day"; This Comes at the End of the First Month's Training at Brooks Field and Gives the "Dodo" the Right to Speak to an Upper Classman without First Asking Permission and Other Privileges

LATEST WATER SPORT IS FILLED WITH THRILLS

Participants in a Greased-Pole Contest That Proved Popular in Florida during the Winter; the Object Is to Negotiate the Slippery Pole and Get the Balloons without a Ducking

For the amusement of winter colonists in Florida, a variation of the greased-pole contest of bygone days has become popular. Instead of being set upright, the slippery pole is placed in a horizontal position, some distance above the water, with a cluster of balloons at its tip. The object of the contestants is to get the balloons, with a fall and a plunge in the water as the penalty for a slip.

SALT MINE BENEATH DETROIT

One of the largest salt mines in the United States is 1,100 feet beneath an important industrial section of Detroit. Despite a production of more than 1,400 tons a day, it is estimated that the deposits are sufficient to last more than 100 years. The salt is blasted with dynamite and a labyrinth of narrow-gauge tracks are winding through the mines. Electric shovels dump and load the salt, and all other operations are controlled electrically, while, at the surface, a twenty-foot ventilating fan drives air into the shaft at the rate of 40,000 cubic feet per minute.

TAIL LIGHT FOR "BUMPERETTE" PROTECTED FROM BREAKING

A combination tail and stop light, constructed to interlock in the rear bumper or bumperette of the automobile where it is protected from damage, now is available. No extra bolts or nuts are required for installation, and the light also completely illuminates the rear license plate. The lens comes in various colors and the panel glass is easily removed to replace bulbs.

The "Brain Wave"

Two Interesting Inventions by Women: A Bolt Which Cannot Be Opened Even if There Is Space between the Door and the Jamb, and, Below, a Baby Carriage Which Can Be Folded to Fit in a Suitcase for Carrying

© The Daily Mirror

© The Planet News

ARE we nearing the age when there will be nothing worth while left to invent?

A few months ago, Sir Alfred Ewing, principal of Edinburgh University, said, "We cannot maintain our astounding pace of discovery and invention. Engineers of the future will not be able to accomplish developments comparable to those of the last hundred years."

No evidence of a decline in inventive ability, however, is to be found in the "Brain Wave" room in London. Here shelves mounting from floor to ceiling are loaded with new inventions—mechanical, electrical and domestic and household—forty thousand of which each year are pouring into the headquarters of the Institute of Patentees.

Among the latest arrivals, in 1929-1930, are a hatpin which need never be taken out of the hat and will always fit into just the same groove in the hair, a non-drip shaving brush with bristles of absorbent sponge, a geyser kettle producing instantaneous and continuous hot water, and a square protective tin, inside which all frying may be done, to prevent splashing of grease on the stove.

A man has invented an ingenious method for papering walls without the splashing of pails of liquid and acres of wall paper, while another has devised a telephone stand with a writing pad which shoots out automatically into the correct position. It is just these little things which may bring inventors big profits, as in the case of the man who, for some years, drew royalties of $25,000 a year from his invention of a collar stud with a movable top.

"All sorts of folk invent all sorts of things," said Capt. G. Drury Coleman, secretary of the Institute of Patentees. "A nurse, a traveling salesman, a plumber a government official, a dry-goods man, a hotel attendant and a parson have just invented devices ranging all the way from the latest helicopter to a method of removing ingrowing toenails. Inventors

© The Daily Mirror

Inventors and Organizers of the London Institute of Patentees Looking at Some of the New Inventions Assembled in the "Brain Wave" Room of 40,000 Inventions

come to our yearly exposition for new inventions, from all over the world—America, Jugoslavia, Norway, South Africa, Germany, India, etc."

The woman inventor is forging ahead in devising ingenious appliances and labor savers for the home and outside it. Many of the ideas are of the kind which make people say: "How simple! Wonder nobody ever thought of that before!"

"At one time," said Captain Coleman, "women inventors failed because, though they had ideas which came to them in the course of their work, they failed to understand some technicality. They did not grasp, for example, that it is no use to patent a new type of saucepan unless it is really exceptional, because no manufacturer making standardized saucepans will scrap his present plant unless he is sure he can sell millions of the new article.

"I remember a wealthy woman in London who some time ago invented a burglar alarm, which, when a crook opened a window, started a phonograph playing a disk of a dog's barking. She spent a fortune on her idea, and, of course, never made a penny out of it. True, it was very ingenious, but most people would find a dog cheaper to buy and keep than the invention. Professor Low once said that a cat would cost less than a certain new type of mousetrap, and would not need emptying.

"I have seen dish washers, masterpieces of ingenuity, wash and dry dishes at the rate of twenty-five a minute; but, as it took fifteen minutes to place the dishes in the patent washer, it was actually slower than the old-fashioned way. But women are becoming more practical, and they have the advantage over men of knowing what is wanted in the sphere of domestic inventions. Every housewife is an inventor, because almost every day of her life, she is making something new or devising some gadget."

At the last international exposition for inventors, the organizers tried out a new notion of asking visitors to drop into a

Second Photo, Courtesy The London News Agency

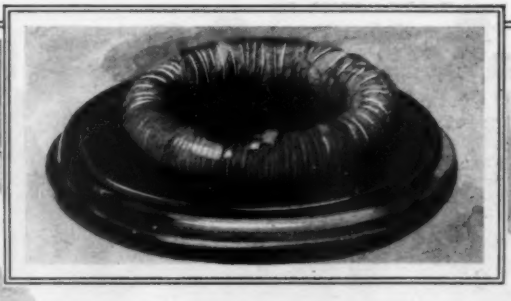
Products of "Brain Waves"; an Amphibious Motorboat at Sea; a New Bat-and-Ball Game Played in Small Space; a Flying Machine That Has Four Horizontal Planes to Elevate the Assembly as They Rotate, and a Bed That Adjusts Itself at the Touch of a Button

box their ideas for a "What's Wanted Competition." Here are some of the ideas dropped into the suggestion box, and it may pay inventors to set their wits to work on them: Wanted, a boot polish that will not soil hands; a reliable and inexpensive means of abolishing washing-up of dishes and plates; a blotless ink; a way to slice onions without making the eyes water; a small cleaner to go into a vanity bag to remove mud splashes from stockings; a way to affix buttons to avoid sewing. A man wants a cream to remove a day's growth of beard without injuring the skin, and a Scotchman asks for a sheet of notepaper that can readily be converted into an envelope, thus dispensing with the need of a separate covering.

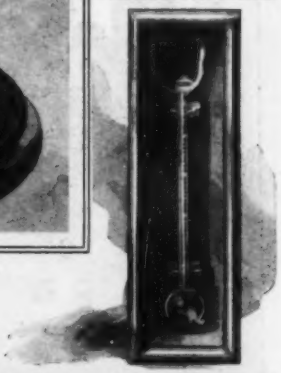
Prizes were given for special labor-saving devices in the domestic and household sections of the inventors' exposition. A special women's prize went to the daughter of a former British navy-department official, who devised a fixture for funnels by which bottles and other receptacles can be filled without any risk of spilling. A man won a silver medal for an improved picture hanger, insuring that a picture, if tilted, returns to the vertical and cannot slip; other men received prizes for inventions to absorb cooking smells in flats and houses; a device which automatically cooks eggs in three ways, soft, medium or hard, and a special range top for a gas stove, to give more than one gallon of boiling water at no extra cost.

A retired sea captain, who turned up at the exposition, has made much money out of his inventions, and can now afford to maintain a workshop. For five years past, he has made inventing a whole-time job. He showed seventeen patents at the exposition and has disposed of half the rights all over the world. They include an electric iron which, if left lying on its face, automatically switches off the current and prevents a fire; a bottle stopper for patent medicines that incorporates a measure graduated in teaspoonfuls; a fire vase concealing a fire extinguisher, and a non-drip coffee or teapot.

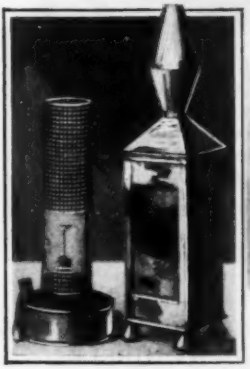
In the electrical section, a man has devised a simple and ingenious invention to show whether any lights have been left in a house after persons have retired for the night. Other inventions prevent gas explosions in street mains and collieries, while a miners' safety lamp shows a red



Faraday's World-Famous Electromagnetic Ring of 1831, a Corner Stone of Electrical Engineering



Faraday's Original Sample of Benzine, a Basic Discovery for Dyes, Drugs and Explosives



Michael Faraday's Original Electromagnet, Made in 1845 and Recognized Today as an Important Step in the Development of Wireless

The Florentine Thermometer of 1665, a Pioneer Weather Gauge of Early Times

Davy's First Safety Mine Lamp of 1815

Series of Vessels Which Sir James Dewar Used to Solve the Problem of Maintaining a Vacuum; the Final Unit, at Right

Bowl in Which Dewar Kept Large Soap Bubbles, Sometimes for Weeks at a Time

Faraday's Specific Inductive-Capacity Apparatus of 1837, Used in Experiments That Blazed the Way for Important Industries

Right Bottom and Center Photos, Courtesy The Illustrated London News

© Topical Press Agency

Demonstrating Portable Bathing Pool Invented by Woman; It Is Made of Waterproof Canvas, Holds 600 Gallons and Is Easily Set Up

light in presence of gas. For use in the bathroom is a toothbrush which can be bent to any shape.

Here are some wants taken from the 1929-30 "What's Wanted Book" of the London institute, which may mean money for inventors: A silent vacuum cleaner; a simple non-leaking tap; a simple device to prevent glass stoppers coming out of bottles when traveling; lining clips to prevent loss of coins from pockets of stooping persons; a device for ridding the air of stale cigar smoke in rooms where, as in winter, the windows cannot be constantly opened; a hard-steel chisel-ended tool for cleaning burnt saucepans quickly; device to lock the last stitch on a sewing machine; a really hole-proof stocking; a substitute for sausage skins; a stove which concentrates the heat on what is being cooked; a wall-papering machine which can be successfully and easily used by an amateur; a quick snow remover from sidewalks; a straw hat not to be discolored by sunlight; a check book that will allow the account to be kept accurately with the minimum of trouble; a non-leaking noiseless valve for steam radiators, and a new road material or new way of road construction which will insure a nearer approach than the present to indestructibility.

AUTOMATIC FISH-HOOK SETTER JERKS LINE AT NIBBLE

Snagging bait-stealing fish the minute they strike is the purpose of an automatic hook setter that may be attached to a pole or reel. The line runs through the hook setter and the least tug on the bait trips a trigger, causing a lever to fly back with sufficient pull to set the hook. The attachment is entirely automatic, working as well on a pole stuck in the ground as on one held in the hand, and it is claimed that it is

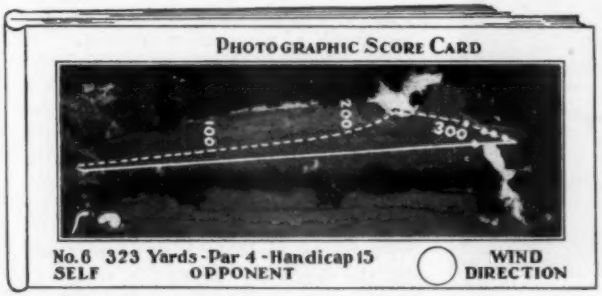
quicker and more sensitive than the hand of the fisherman. For reels, the setter is so constructed that, after the first jerk, it snaps back out of the way, giving the angler a free hand to manipulate the line.

LUBRICANT FOR TROLLEY WIRES FREES THEM OF ICE

Trolley wires may be kept free of ice and sleet in winter by applying grease to them, and a Michigan street-railway company recently developed a device to replace the slow method of hand application. A lubricating paste mixed with water was placed in a tank on a work car, the tank being kept under thirty pounds' pressure from the car compressor. The lubricant is forced through a flexible tube attached to the trolley pole ending in a nozzle which sprays the wire. Excess lubricant drops into a receptacle and drains back to the tank.

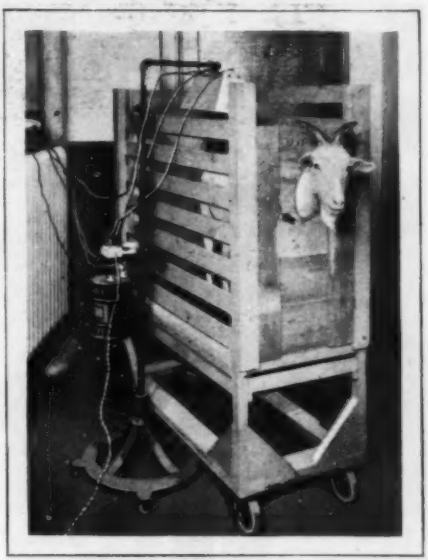
AERIAL GOLF-SCORE CARDS TELL STORY OF GAME

Aerial photographs of golf courses are now being prepared in score-book form so that records of the games may be preserved in a pictorial manner. The photos clearly show the fairways, obstructions and other details of the course, so that the performance of the players may be indicated by lines, tracing the path of the balls between the holes. The cards may be used more than once or preserved as a permanent record. The distance of each shot, wind direction and other data are kept on the cards.



Golf-Score Card Containing Aerial Photo of Course on Which Player's Performance Is Indicated by Lines as Permanent Record

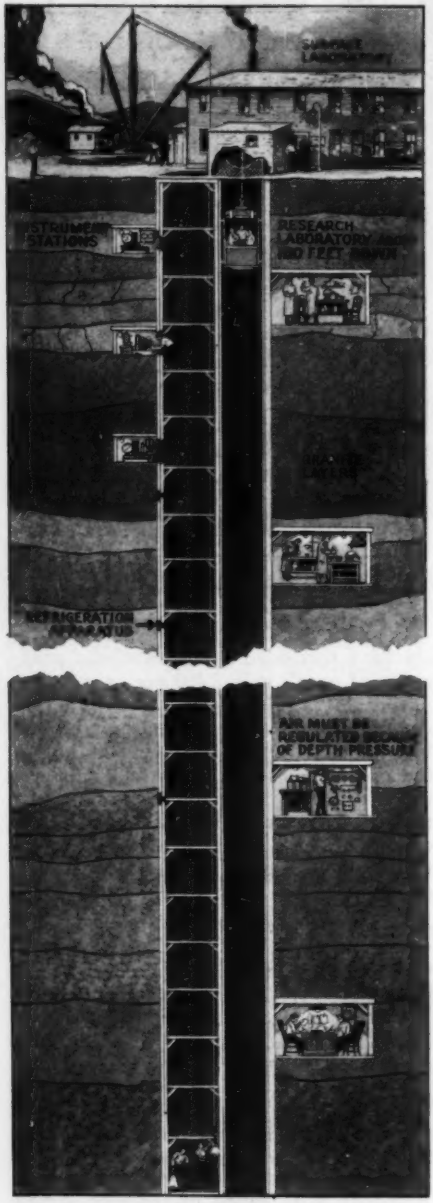
ULTRAVIOLET RAYS FOR GOATS IMPROVE MILK QUALITY



Goat Being Treated with Ultraviolet Rays to Increase Antirachitic Properties of Milk

Scientists of the University of Wisconsin have increased the antirachitic properties of goat's milk 2,400 per cent by exposing it to ultraviolet rays. The increase was also effected, although in a less degree, by the direct irradiation of the goats themselves. Marked improvement in the bone-building quality of the milk was shown by but two hours' irradiation of the goats in four days. Ultraviolet rays have no effect whatever on cows or on the milk they produce, and investigators decided that the results obtained with goats was probably due to the difference in body area as compared with the volume of milk produced, and because of secretory functions of the milch goats' skin that are lacking in the dairy cow. Goats irradiated for long periods eventually lose much of the lime stored in their bodies, as does also codliver oil.

RIDDLE OF THE STARS SOUGHT IN DEPTH OF EARTH



Artist's Conception of Shaft, Two Miles Deep, with Laboratories at Various Levels, in Which Scientists Would Determine if Universe Is "Running Down"

Locked only a couple of miles below the surface are the answers to many of the riddles of the stars and mysteries of the earth which are baffling the world's greatest scientific minds, according to Prof. Harlow Shapley, internationally famous director of Harvard observatory. So, he seriously proposes the sinking of a vertical shaft as deep into the earth as may be found practicable, and the establishment of subterranean laboratories along its sides in which could be tested the theories advanced by leading scientists to explain how and when the earth, the planets and the stars originated; how they are organized and distributed, the controlling factors of their movements, evolution and existence, the stability of matter and energy, and the dimensions of space.

"The carrying out of such projects is not beyond modern engineering skill, and the idea is entirely feasible and worthy of serious consideration by national governments and great organizations interested in the advancement of science," Professor Shapley declares.

A vast amount of money and many valuable lives have been devoted to explorations of the polar regions, but the scientific knowledge and possible material results of such explorations are not to be compared with Doctor Shapley's picture of what civilization has to gain by a great engineering probe of the "innards" of the earth.

You may not have noticed any change in the length of the day, that is, the twenty-four-hour day, but Doctor Shapley tells us that it is lengthening at the rate of one thousandth of a second a century. That may not impress you as being a circumstance for anybody on earth to be concerned about. But the astronomer considers it a mighty important and mysterious phenomenon indicating the earth is running down, and it naturally suggests the question of whether or not the universe also is running down.

"For some years we have been familiar with the fact that the earth's rotation is slowing down, that the day is getting longer, and that the moon is gradually re-

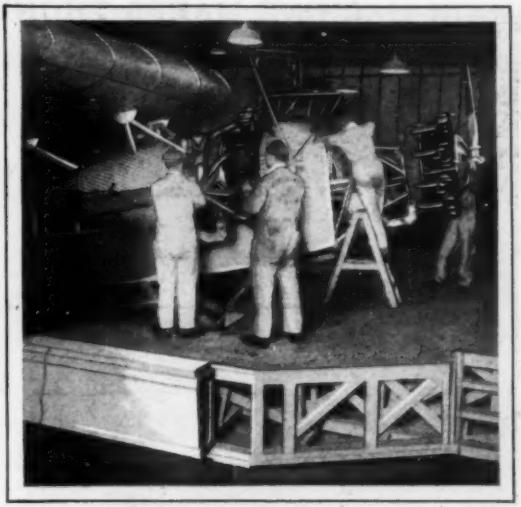
ceding from the earth about seven feet per century," Doctor Shapley explains. "And our observations tend to show that our universe is running down too. The sun is losing mass at the rate of about 4,000,000 tons a second, and all the other stars are radiating their matter away at rates proportionate to their magnitude. Millikan speculates that the energy of radiation is translated back into matter. But it is only speculation, not evidence."

Linked up with this problem are the perplexing wabbles of the earth which are responsible for latitude variations. The earth's poles wabble and wiggle all over the map, so to speak. Astronomers now cannot predict in advance where the pole will be at any particular time, but ultimately they hope to be able to do so, and the underground laboratories would help to solve this mystery.

"Such laboratories would also be of great value in testing the theory that the American continents are drifting away from the African and Eurasian continents," said Doctor Shapley. "If the Americas split away from Europe and Africa at some time in the dim ages of the past and have drifted since to their present location, there is no reason to suppose they have stopped drifting. Nevertheless the drift is so infinitesimal that it is impossible to determine accurately with our present equipment. But if such a drift is going on it might readily be studied from the bottom of a shaft dug a few miles into the earth."

Doctor Shapley stated that by-products of such scientific boring into the earth would be an investigation of the commercial possibility of tapping and utilizing the earth's internal source of heat, and a better knowledge of its mineral wealth.

"Installation and maintenance of such a tube will be a scientific adventure of great difficulty and expense," he admitted, "but if carried on in connection with work in existing mines and borings, it may mark the coming decade as one of the important epochs in man's attempt to understand the earth."



Portable Service Platform for Airplanes Which Gives Mechanics Easy Access to All Parts of the Engine

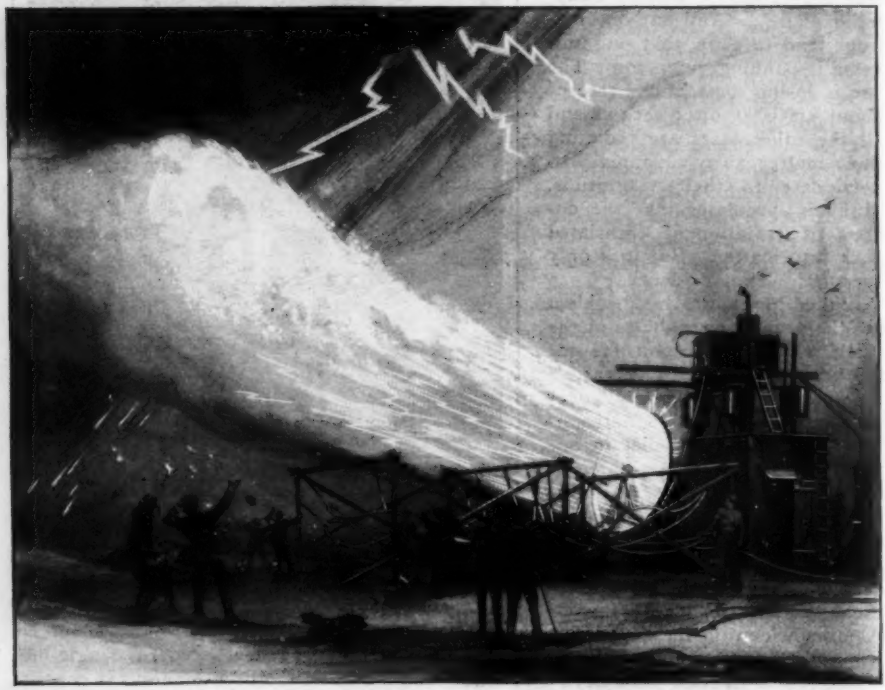
WORK STAND FOR PLANE ENGINE GIVES EASY ACCESS

Making all parts of an airplane engine easily accessible to mechanics, a service stand has been developed for single-motored and tri-motored planes. It consists of a substantial platform equipped with shelves for tools, vises and other needed equipment. It is built on casters so that it can be moved from plane to plane.

OPEN SHELTERS AT CAR STOPS FOR TROLLEY PATRONS

Open shelters for trolley-car patrons have been constructed at regular stops by one mid-western traction company. The platform structures are bolted to a concrete base, being about four and one-half feet wide and six feet from base to eaves. A partition built at right angles in the center affords protection from wind, and, with the roof and back, offers shelter from rain and snow.

RAIN MACHINE MAKES THUNDER AND LIGHTNING



Rain-Making Machine with Artist's Conception of a Manufactured Thunderstorm; Artificial Mist Charged with Electricity Blown into a Humid Atmosphere Causes the Precipitation

Most picturesquely remarkable of recent scientific achievements has been the making of rain—not an imitation of rain, but the real thing, although it is discharged from artificially produced clouds. Means have been found whereby not only clouds can be formed, and rain caused to fall, but actually thunder and lightning are in some instances produced. A machine does it all, but an indispensable requirement is that the atmosphere shall be humid. No such effects could be obtained in the dry air of a desert. The experiments which have yielded such amazing results have been in progress for some months past at Mustin field, Philadelphia, belonging to the navy department. The apparatus consists of water tanks, an airplane engine fitted with a propeller, and a 75,000-volt transformer. In front of the propeller, and connected to the tanks, is a ring of one-inch pipe perforated all around with tiny holes. The ring acts as an atomizer, seventy-seven gallons of water being blown through its holes each minute, to form an artificial mist. The ring is charged to so high a voltage that sparks six and a half inches long may be drawn from it when the current is turned on. Thus, when the water is blown through it outward, the mist thereby dispersed is heavily charged with electricity. The mist is so fine that it immediately evaporates, leaving a heavy charge of electricity upon the humid air. This electrical charge, in turn, ionizes the particles of moisture in the air, causing them to run together and form drops which fall by gravity to the earth, making rain. The mist is discharged with great force in the direction of the wind, traveling with the latter some hundreds of feet before it evaporates. Presently, as observed again and again, a black cloud forms "down the

wind," dense and threatening. A few minutes later, it is likely to discharge rain, and on more than one occasion, this has been accompanied by thunder and lightning.

COURSE MARKER FOR VESSEL IS AUTOMATIC

Automatically marking the true course of a ship on the vessel's chart, an apparatus known as a "dromograph" has been invented by a French naval officer and successfully tested. It indicates the ship's exact geographical position at any time and also its precise course in arriving at the location. A stylus marks not only main changes in the course, but also smaller variations resulting from the helmsman's operation of the rudder.

ABILITY OF SINGER IS TESTED BY VOICE-WAVE RECORDER

Those with operatic ambitions now may test their voices with a machine instead of attempting to obtain an audition before persons competent to judge voice quality. Students and professors of the University of Iowa have developed an instrument called a tonoscope, which registers the waves of the voice.

Instrument Which Tests a Singer's Voice by Registering Tone Waves as They Are Produced

Auto Trailer Which at Night May Be Expanded to Provide Sleeping Quarters for Four Persons

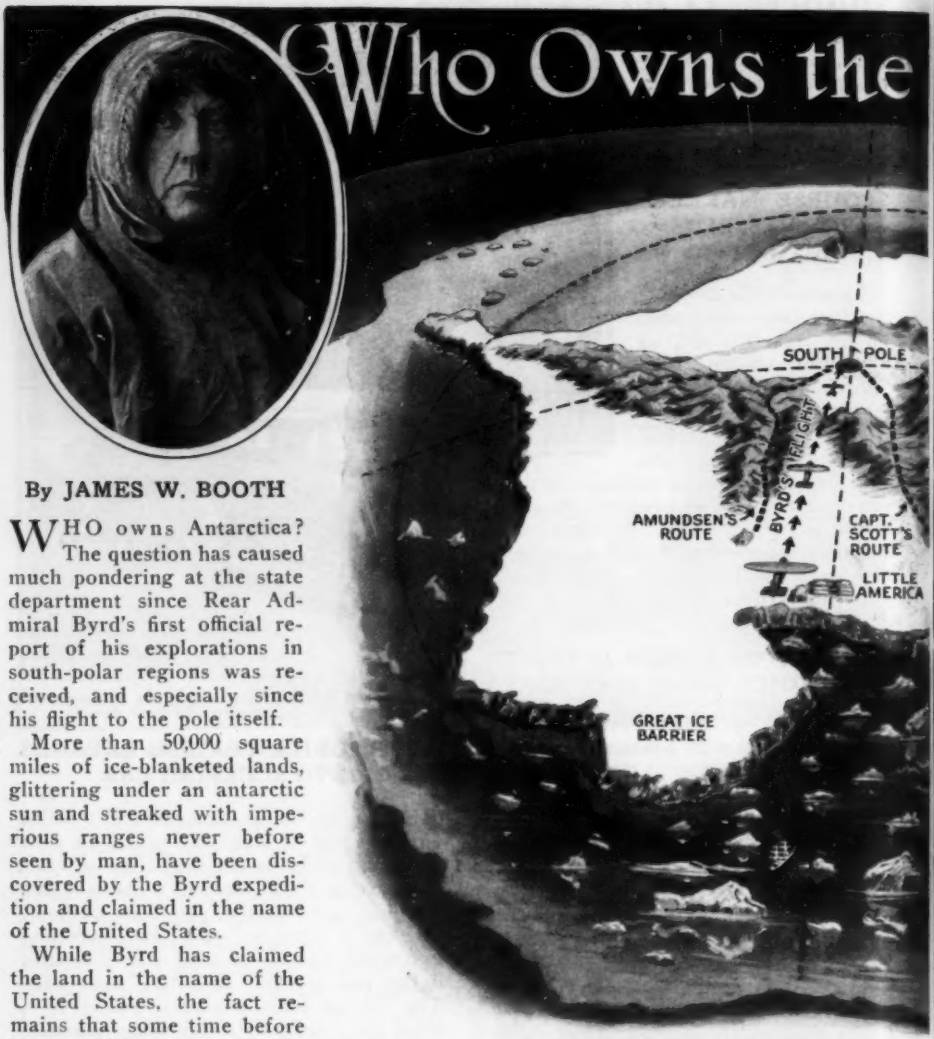
AUTOMOBILE TRAILER EXPANDS INTO SLEEPING CAR

Expanding like an accordion to a width equal to that of a railway coach, an auto trailer no wider on the road than an ordinary car, at night becomes a commodious sleeping compartment for four persons. The car is equipped with two lower and two upper berths, running water, electric lights and special ventilating apparatus. The change from a narrow trailer to a hotel on wheels takes only a few minutes.

STEAM-HEATED RADIO AERIAL

Radio station WEBR, of Buffalo, uses a steam-heated radio aerial to prevent the forming of ice and sleet on the antenna and mast during winter storms. Hot steam at high pressure is piped into the interior of the mast, a huge metal pole on the roof of a ten-story warehouse. The mast thus is kept warm enough so that ice cannot form and ground the circuit.

Who Owns the



Drawing of Antarctica, a Land Larger Than All Europe, Showing Routes of Two Famous Explorers; Inset, Capt. Roald Amundsen, Who Reached the South Pole Thirty-Two Days before Capt. Robert F. Scott

By JAMES W. BOOTH

WHO owns Antarctica? The question has caused much pondering at the state department since Rear Admiral Byrd's first official report of his explorations in south-polar regions was received, and especially since his flight to the pole itself.

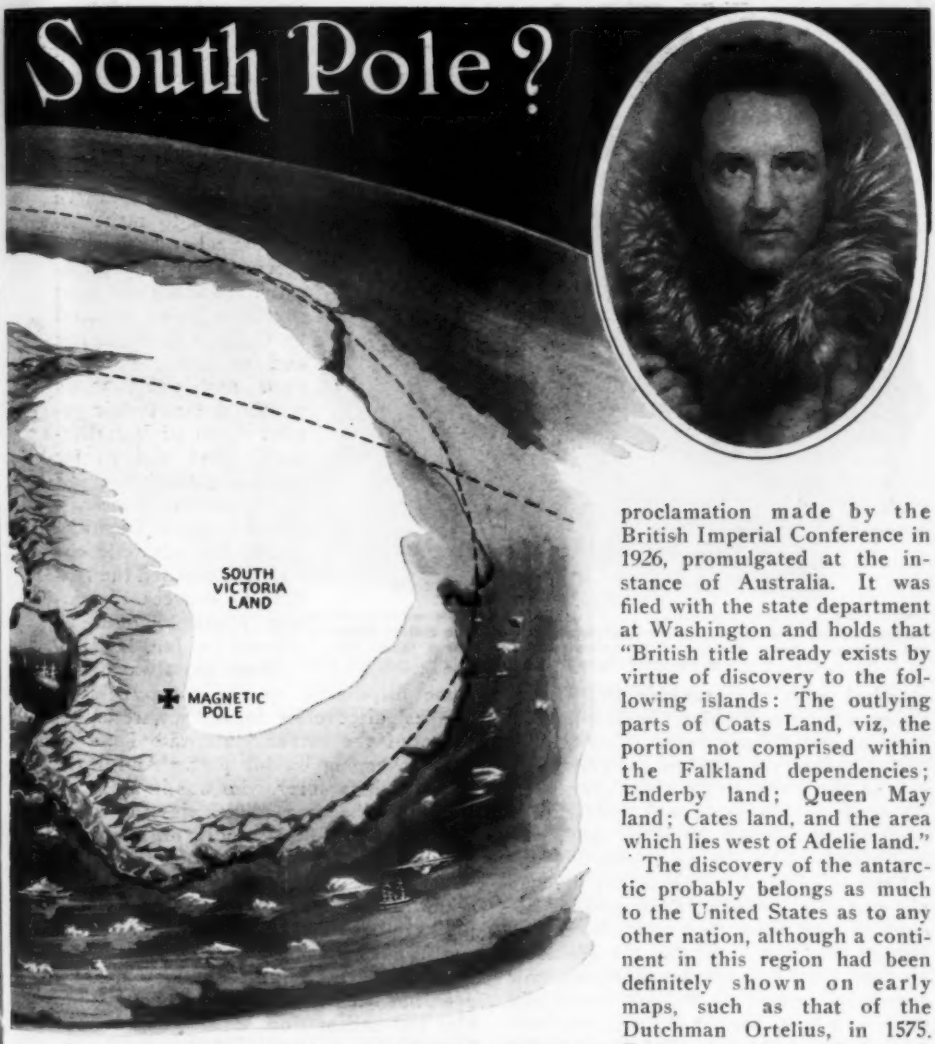
More than 50,000 square miles of ice-blanketed lands, glittering under an antarctic sun and streaked with imperious ranges never before seen by man, have been discovered by the Byrd expedition and claimed in the name of the United States.

While Byrd has claimed the land in the name of the United States, the fact remains that some time before he set sail for Antarctica the British government filed with the state department a communication granting permission to the explorer to use territory claimed by it in south-polar regions, but setting forth that it had sovereignty over certain lands there.

It was a harmless enough little note, and the state department did not pay much attention to it. Byrd's discoveries, however, now bring to the fore the question of actual ownership of these more than 50,000 square miles. On the surface, the land is apparently of no great value, but what if it should contain untold mineral wealth, oil, gold, etc.? Then it would be of great value.

Previous to the airplane, the antarctic continent lay silent and alone, its face screened from prying eyes of the world,

South Pole?



Captain Scott and His Entire Party Perished on Their Attempted Return from the South Pole; Inset, Rear Admiral Richard E. Byrd, Who Flew over the Pole and Returned Safely to His Base

beneath a mask of impenetrable snow and ice and roaring winds. Only the most meager reports of its character have been brought back to the world by the intrepid explorers, Wilkes, Ross, Shackleton, Palmer, Amundsen, and others.

British claims in Antarctica, if allowed, would affect practically all future exploration work there. The claims follow a proclamation made by the British Imperial Conference in 1926, promulgated at the instance of Australia. It was filed with the state department at Washington and holds that "British title already exists by virtue of discovery to the following islands: The outlying parts of Coats Land, viz, the portion not comprised within the Falkland dependencies; Enderby land; Queen May land; Cates land, and the area which lies west of Adelie land."

The discovery of the antarctic probably belongs as much to the United States as to any other nation, although a continent in this region had been definitely shown on early maps, such as that of the Dutchman Ortelius, in 1575. Early voyages to the south seas, particularly that of Cook in 1775, revealed the fact that there was no connection between South America, Africa, Australia or New Zealand and any land that might be found near the south pole.

To counteract British claims in Antarctica the United States probably will declare priority discovery. There is the claim of Capt. Nathaniel B. Palmer, a whaler from New London, Conn., who

Sextant Camera That Photographs a Complete Reading of the Sun to Show the Observer's Exact Position; This Instrument Has Been a Great Aid to the Byrd Expedition

attached with his eyes for the United States what the Russian, Bellingshausen, later named Palmer land. That was in 1821, eighteen years before the great voyage of Ross, the English explorer, after whom Ross sea is named, and who in addition, discovered Victoria land, several islands and an active volcano.

Captain Wilkins, in 1928, under the auspices of the American Geographical Society of New York, flew south from near Palmer land and found that the peninsula resolved itself into two large islands, now commonly known as Palmer island and Graham island, separated from the antarctic mainland by an island-dotted strait.

From these discoveries the United States could lay claim to considerable areas in this region, namely, the major part of Palmer island and the southeastern part of Graham island, and islands and coast to the south.

The year following Ross' discoveries, if the "I saw it first" rule is to determine ownership, the United States gained more territory by the expedition of Capt. James Wilkes, of the United States navy, acting under mandate of congress, which discovered Wilkes land in January or February, 1840.

Wilkes left Hampton Roads on Aug. 18, 1839, with orders general in character, to do exploration work in the southern Pacific and to make astronomical and other observations and, specifically, "to reach the most southern point reached by Cook in the antarctic and to make observations and collections within the antarctic region south of Van Diemen's land and as far south as Enderby's land." Cook was the first navigator known to have passed the antarctic circle. He reached the latitude 67 degrees 15 minutes in east longitude 39 degrees on Jan. 17, 1773.

There has always been some dispute as to the correctness of Wilkes' discoveries in the antarctic because of the rather inaccurate habit of record keeping on his part. And Ross, the British explorer, who was in antarctic waters at the time Wilkes was there, declared that Wilkes' report of land was without substantiation of fact. As a result Wilkes' claims were clouded with doubt and, worse still, the American people have been inclined to let them remain so. Wilkes was not a popular figure with the public. Sir Ernest Shackleton, however, has been instrumental in getting for him the recognition which should have been his years ago. Today, as a monument to his work below the Capricorn, exists Wilkes land.

While Great Britain lays claim to the Falkland island dependencies, this claim could easily be challenged on the basis of discovery. It is true that Cook, Ross, Powell, Wendell and Shackleton all did pioneer work in various parts of this region, but so did men of four other nationalities, particularly Bellingshausen, the Russian; D'Urville, the Frenchman;

Rear Admiral Byrd and His Companions at the North Pole; Byrd, Then a Lieutenant Commander, Electrified the World by His Spectacular Airplane Flight across the "Upper Roof" of the World

Larsen, the Norwegian, and Filchner, the German.

As far as the Ross dependency claim is concerned, if discovery amounts to anything, Great Britain seems to have some justification for her claim to the land nearly up to the pole on the west side of the region, because here Shackleton came within ninety-seven miles of the pole before Amundsen; and here Scott actually did reach the pole soon after Amundsen. However, Borchgrevink's exploration near Cape Adare and Amundsen's dash to the pole give Norway a basis for claims in this area.

The United States has so far never claimed land in the antarctic, not even in the case of Wilkes land, discovered by an official expedition. Charles Evans Hughes made the announcement, as late as 1924, that "it is the opinion of the state department that the discovery of lands unknown to civilization, even when coupled with a formal taking of possession, does not support a valid claim for sovereignty unless the discovery is followed by an actual settlement of the discovered country."

Admiral Byrd, while knowing the position of the United States on claiming land in the antarctic, evidently wanted to be on the safe side, as Dr. Isaiah Bowman, of the American Geographical Society, recently pointed out: "In order to avoid the consideration of the new discoveries as mere continuation by land from the Ross dependency, it seemed desirable to make an independent tie-up with the coastline in case further consideration of the discoveries makes it wise for the United States government to set up a specific claim."

France is the only country besides Great Britain which now lays definite claim to land in the antarctic. Her claims are based on the voyage of D'Urville in search of the south magnetic pole in 1840. D'Urville was in the region of 140 degrees east visited by Wilkes the same year, and first saw Antarctica less than one day after Wilkes did. He was in ignorance of Wilkes' prior discovery. He landed on a small islet near the coast and called the place Adelie land. The claims of France were published in March, 1924, in the Journal Officiel, and were made to reserve the rights of fishing, hunting and mining in the region to Frenchmen.

Girl Listening to Herself Think through Electrodes in Mouth Connected by Radio Apparatus

"WHEELS" OF BRAIN ARE HEARD AS THOUGHTS FORMULATE

Literally hearing the "wheels" of your brain go round as you think has been made possible by a combination of radio devices developed by Dr. Milton Metfessel, authority on speech defects, of the University of Southern California. Electrodes held in the mouth pick up tiny disturbances set up in the tongue by nerve impulses from thoughts, these impulses being amplified and made audible by the combination of radio instruments. Thus one can hear his own brain working.

RUBBER MATERIAL X-RAY PROOF

As a substitute for sheet lead, a rubber compound has been developed that is an effective shield against X-rays. The material, which can be made thick enough to resist penetration of the most powerful rays, is intended as a lining for rooms where X-rays are used and has been named "ray rubber." It resembles ordinary rubber floor covering and normally is made in sheets one-half inch thick, in which form it is equal in protection to sheet lead one-eighth of an inch in thickness. Sheet lead requires nails to hold it in place and the nails are not always opaque to the rays, but the rubber can be cemented to floor or walls. The compound is essentially a rubber sheet containing finely divided lead.

A FLOATING FACTORY

Having served its time for a quarter of a century as a cable-repair ship, a vessel on the southwest African coast has been converted into a floating plant dealing in fish products. Instead of hauling the fish to the factory, the vessel proceeds to the raw product, either making the catch itself, or going to coast towns at fixed periods to work up the catch awaiting it. The floating factory makes fish meal and also cans crayfish.

WARNING FOR LAZY WORKMEN ATOP RUSSIAN FACTORY

Lazy Russian workmen are given a visible warning of the fate awaiting their country if they loaf, by a fantastic puppet attached to a crane atop a Moscow textile factory. The grotesque sign, in the modernistic style, predicts ruin of the country unless all join in a program of construction.

Warning over Moscow Factory Intended to Depict Ruin of Russia if Workmen Are Not Industrious

Former German Yacht at Miami, Fla., Which Has Been Transformed into an Aquarium; What Seems to Be the Towering Mast Is Actually the Top of a Building in the Background

BOAT TURNED INTO AQUARIUM UNIQUE IN APPEARANCE

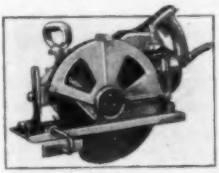
At Miami, Fla., the former German yacht "Prins Valdemar" has been transformed into an aquarium. From a distance the craft, anchored in an inlet of Biscayne bay, appears to be resting on land, while the spire of a stately building in the background seems to be its mast.

QUEER QUIRKS OF ACID

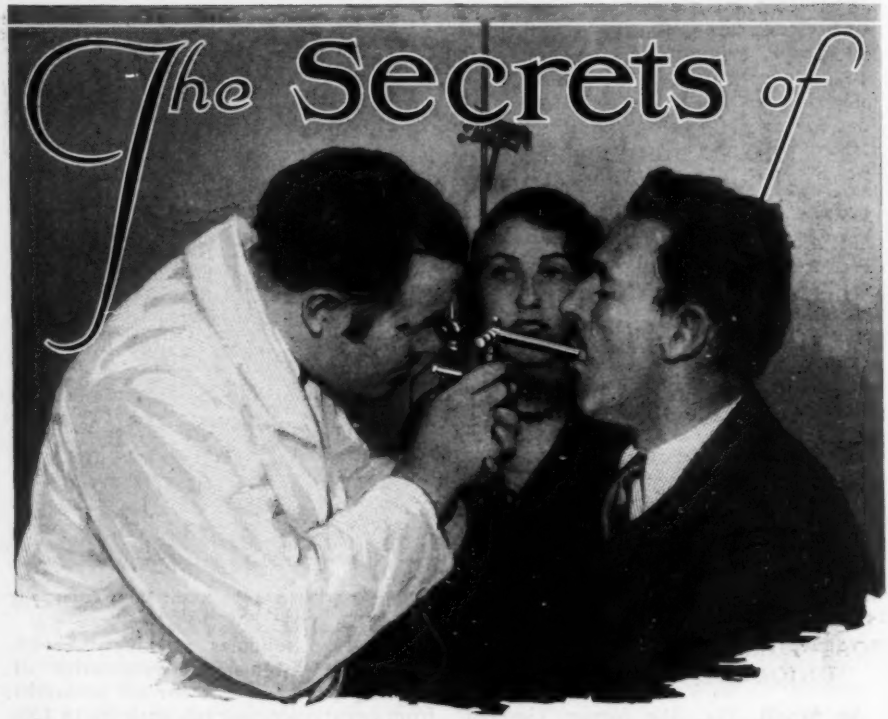
Sulphuric acid possesses many queer and apparently contradictory traits. Steel tanks unaffected by 100-per-cent acid are ruined by the same acid after it has been weakened with water below sixty-five per cent. The weaker acid can only be kept in lead, rubber or glass containers. On the other hand, strong sulphuric acid will disintegrate lead and rubber, glass being the only material that will hold all strengths equally well. Seventy-three-per-cent sulphuric acid will remain liquid at twenty degrees below zero and a ninety-three-per-cent solution does not freeze at ten below, but an eighty-three-per-cent solution freezes at forty above zero and 100-per-cent solidifies at ninety above. The same astonishing irregularity of freezing point obtains for all strengths from twenty-per-cent sulphuric up to 120-per-cent fuming acid.

PORTABLE ELECTRIC RIPSAW HAS AUTOMATIC GUARD

Compact and light in weight, a portable electric ripsaw now is on the market, operating on either direct or alternating current. The saw may be obtained with either ten or twelve-inch blade, and a swinging guard covering the lower part of the saw is automatic in operation, pushing out of the way when cutting pressure is applied and returning to guarding position when the pressure is released. The upper portion also is provided with a removable guard. Ball bearings and spur and bevel gears eliminate wear and heating. A steel carrying case is provided. Either size weighs less than thirty pounds.



The Secrets of



Instrument Which Facilitates a Multiple View of the Human Voice in Action, Making It Possible for from Two to Eight Observers to Watch a Voice at Work Simultaneously

Science Discloses That Traditional Theories about Speech and Voice Quality Are Wrong

By GEORGE H. DACY

UNRAVELING the age-old mysteries of human speech, voice quality and the singing superiority of the operatic stars is a field of research which has yielded new grains of knowledge recently.

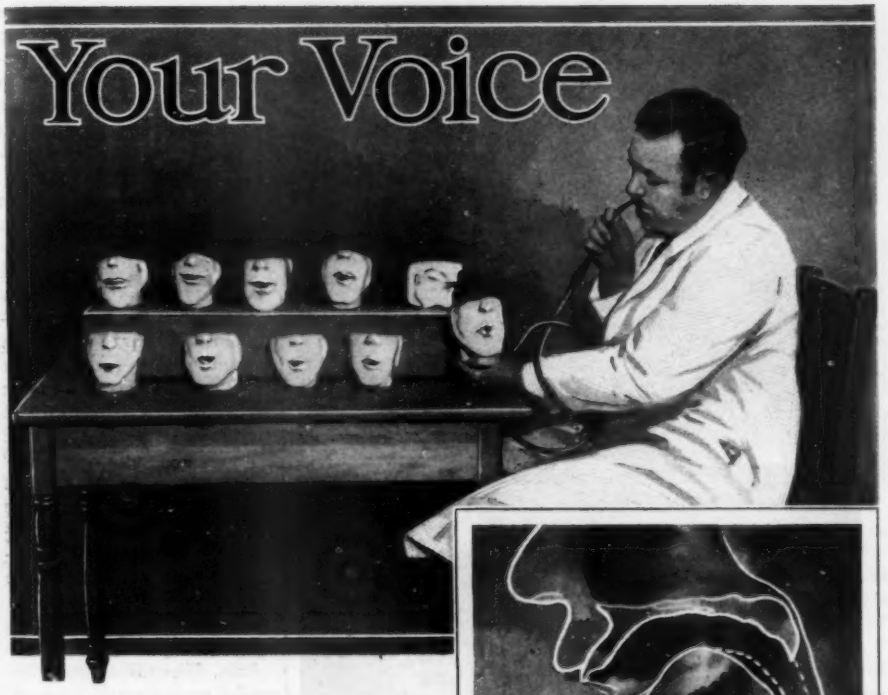
Both X-ray and motion pictures of the human voice in action, synchronized with simultaneously produced phonographic records, have been made. Research has developed miraculous appliances which enable the speaker or singer to watch his vocal cords in action as he talks or sings.

Dr. G. Oscar Russell, director of the phonetics laboratory at Ohio State University—the finest of its kind in the world—was the first to observe and photograph the human voice at work. Doctor Russell is the originator of a marvelous apparatus called the "laryngoperiskop," which makes the organs of speech visible as they operate in ordinary conversation.

This instrument is a glistening metal tube equipped with a series of lenses, prisms and a tiny electric bulb of wonderful brilliancy. This light illuminates the inky darkness of the voice chamber. The picture is reflected so that the observer who gazes into the opposite end of the tube can watch the voice in action.

Science for generations has believed that certain voice characteristics, tone qualities and song notes were dependent upon the size of the mouth cavity, vocal chamber and throat aperture. By means of his unique "throat telescope," Doctor Russell has observed that many of these

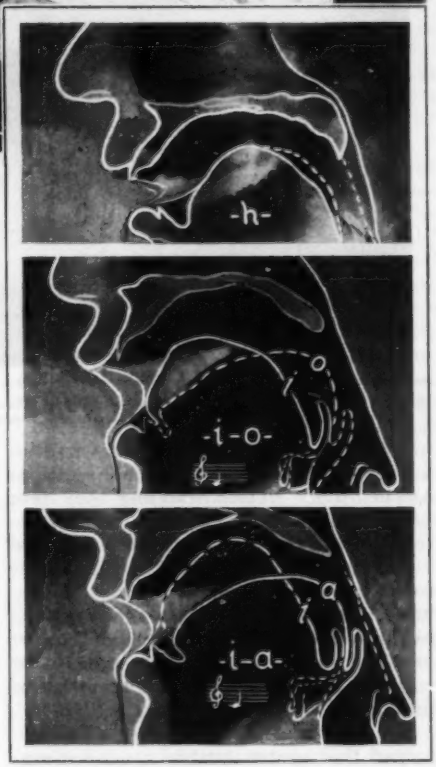
Your Voice



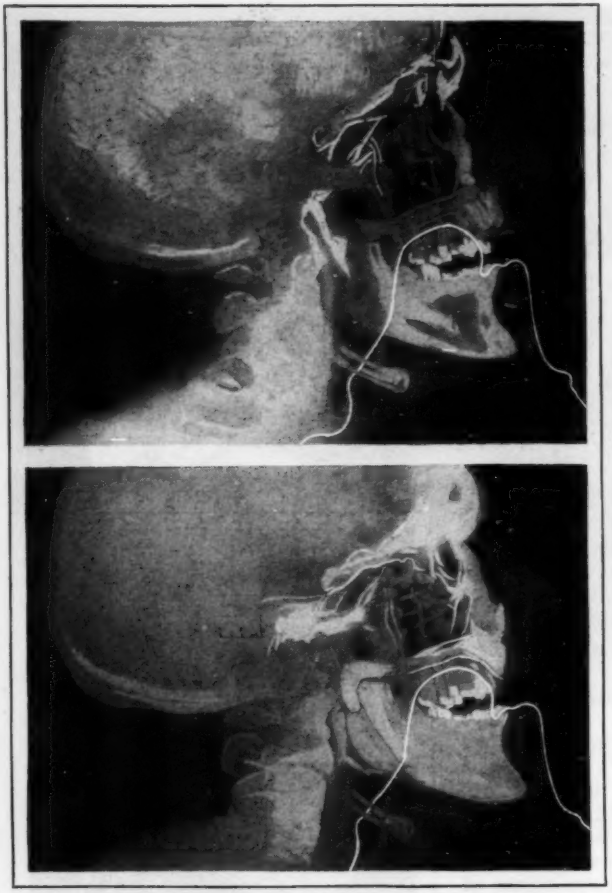
properties of speech and voice are also dependent on the play of infinitely small muscles inside the Adam's apple. The true and false vocal cords, the "trapdoor" to your Sunday throat, and the softness or hardness of the walls against which the tones strike or between which they must pass in issuance from the organs of speech, also influence the voice.

Assisted by F. G. Haskett, the university photographer, Doctor Russell linked a regulation camera to his laryngoperiskop and made the first pictures ever taken of the human voice uttering vowel sounds and singing low and high-pitched notes and booming bass gutturals. Subsequently, Doctor Russell extended his research to the production of clay models made from pictures and measurements of the organs of speech at work. These models are facsimiles of the lower half of human heads. Cross sections of the models represent accurately the changing positions of the organs of speech as various vowels are spoken.

Doctor Russell has attempted to make



Above, Clay Models of Human Voice Organs Reproducing Sounds; Below, How Voice Looks Making Sounds Representing "H," "IO" and "IA"



X-Ray Pictures of Person Who Has Swallowed Thread and Is Speaking Vowel Sounds as Exposures for Voice-Study Research Were Made

his clay models talk. They are as faithful artificial imitations of the human voice as can be made. Notwithstanding, they have been unable to speak as man does. Doctor Russell believes that these artificial voices are unable to simulate man faithfully in speech because certain inharmonics—non-musical factors as well as high-pitched partials—are responsible for peculiar notes in the human voice. It was impossible to reproduce these peculiarities in the clay models.

These voice-study experiments have divulged that speech quality can be stimulated measurably by passing an electric charge into the body through the external throat muscles as the voice is engaged in song. One terminal of the electric circuit is attached to the wrist of the subject while the circuit is closed by pressing the other terminal against his throat. The electricity lowers the voice tone of the person thus stimulated and produces a distinct guttural quality in his speech.

Doctor Russell demonstrated that the false membranes — incorrectly called false cords—in the throat play an important role in creating speech and voice quality. They contract and close when one coughs and are the major sources of whatever guttural quality exists in your voice. In the rendition of high notes, these false membranes clash together like cymbals. They become either sharp-edged, round-edged or blunt as successive tones and notes are produced by the singing voice.

The X-ray pictures show the changes in cavity dimension and tongue position in uttering different sounds and vocal notes. They disprove without exception existent theories about how we talk and sing. Actually, the tongue arches all the way back to the soft palate, producing a long neck with a large cavity behind it when man speaks or sings. The tubes really function like irregular or spherical resonators rather than as pipes in producing various vowel sounds.

Our vocal cavity, so the Russell experiments prove, is exclusively a "one-piece" structure from the exit of the sound at the epiglottis on out to the teeth. This refutes all previous theories on the subject—both scientific and empirical. The narrow vocal cavity used in saying "aw" is lined with back throat soft tissues while

Stimulating the Human Voice with Electricity and Recording the Effects Phonographically, Thus Comparing Tone Variations with Records of a Vibrating Tuning Fork

the "ee" cavity is created by arching the tongue against the hard surfaces of the front mouth. Both these cavities in principle resemble the ordinary megaphone.

Musical research has divulged that different surfaces change the quality of flutes. An organ pipe provided with double walls, between which water can be poured, will change its quality from thirty to forty times during such a test despite the fact that the dimensions of the resonance cavity remain constant. Varying surfaces in the vocal chamber similarly create quality differences in the speaking and singing voice. Soft surfaces in the throat, for example, muffle the sound or mellow its quality especially where the tube is narrow in relation to the total area. The same thing occurs if sound is passed through a soft-surface tube. The soft surfaces filter out certain sound frequencies.

Through the co-operative aid of the Carnegie Foundation and at the special request of the American Academy of Music Teachers and Singers, Doctor Russell will continue certain of his voice-research experiments at the College of Physicians and Surgeons, in New York City, in an effort to answer the existent riddles of professional singing. What differences account for the variations in soprano and alto tones when singing the same note? How can this new and revolutionary knowledge about the human voice be yoked most efficiently for the future training of singers and the development of grand-opera stars? Can a standard practice system be evolved for the molding and seasoning of the million-dollar voices of the operatic tenors, baritones and basses?

Doctor Russell says that the average singing teacher's definition of resonance is entirely wrong. The position of the tongue has little, if any, effect on the quality of the singing voice. In rapid speech, the tongue assumes all kinds of strange postures and positions. The unit of loudness in the singing and speaking voice is difficult for the lay mind to comprehend. Strange to say, the energy used in ordinary conversation is so minute that the voices of 1,000,000 persons speaking in unison would represent only enough energy to light the ordinary incandescent bulb. When the human voice changes from normal speech to song, its energy volume is increased anywhere from 10,000 to 100,000 times.

This renders the scientific reproduction of the human voice very difficult for technical research purposes. Doctor Russell employs a system of networks and filters to eliminate undesirable "blasts" of sound. If you are familiar with the radio broadcasting of song, you probably know that professional singers are required to sing in "light" voice before the microphone for satisfactory reproduction. They can-

A Picture of the Vowel Sound "I"—an Accurate Cross-Section View of the Human Voice as It Is Uttering This Sound

not sing naturally and in full volume as they would before a concert audience. Many singers, in fact, are barred from radio appearances because they either cannot or will not modify their voices to meet these requirements.

In his study of the singing voice, Doctor Russell expects to develop demonstration phonographic records for general use. These will be accompanied by supplementary X-ray pictures which will show what goes on in the throat, mouth and even down in the larynx at any interval in that voice reproduction process. Both students and teachers thus will be able to see and hear what occurred as the subject sang while the X-ray pictures and records were made. This new method of voice culture will demonstrate among other things that various voice qualities are created down in the larynx behind the Adam's apple. They will show how tight, constricted voices are due to the tenseness of the laryngeal muscles which prevent the vocal membranes from vibrating freely. Song science in the future will attempt to relax that condition which may develop in voices that otherwise are promising. Singing voices which now fail in extreme tests will potentially be fortified and reinforced against commercial failures as a result of Doctor Russell's contributions to human knowledge.

Tight, constricted voices are due to the muscles which assist sound production normally pulling against each other and at cross-purposes. The singer can even observe these muscular manifestations by placing his finger underneath his chin as he sings. The use of the bizarre "throat telescope" and "voice spyglasses" proves that guttural qualities in the human voice which accompany low pitches are caused by the pull of special muscles that carry a soft round cushion, located at the base of the epiglottis, back against the cartilages of Wrisberg, leaving a loose flabby mass directly above the vocal membranes. When the membranes vibrate, this cushion flaps about slowly and produces the guttural tones. By the future capitalization of such precise scientific knowledge as this, singing voices which fall short of operatic superiority can be trained in view of these revelations of how the voice works to sing as melodiously as the world's outstanding songsters. Science will thus aid in transforming handicapped human songbirds into high-salaried operatic stars.

CALENDAR HOLDS MILK TICKETS

Milk coupons and a calendar are combined into one handy kitchen accessory for the customers of an eastern dairy company. The coupons are held at the bottom of the calendar, and when the housewife desires an extra order of milk, she simply detaches one of the perforated slips and leaves it with the milk bottles.

PLANTS FIND PLUMBING LEAK BY REACTION TO GAS

House plants, particularly carnations, sweet-pea sprouts and castor beans have been used successfully to detect gas leaks where other means have failed because of their extreme sensitivity to ethylene gas, which occurs in coal and illuminating gases. One part of ethylene gas in 400 parts of air is the minimum that can be detected by odor, yet as little as one part in 10,000,000 will have its effect on plant life. The carnation is a more sensitive gas detector than the apparatus of the average chemist, and will "fold up" when one part of ethylene gas is present to 1,000,000 parts of air. Sweet-pea sprouts develop goiterlike growths, and this fact has been used in finding a leak in a home gas line by placing the sprouts at various suspected areas and observing the results. The castor-bean plant's leaves are so extremely sensitive that they will change position when as little as one part of ethylene gas to 10,000,000 parts of air is present.

BOWLING WITH A BILLIARD CUE COMBINES TWO GAMES

Combining many of the features of both bowling and billiards, the game of "skill ball" recently has made its appearance. The table on which it is played is waist-high, but in other respects resembles a bowling alley with light pins at the end. Billiard balls are shot at the pins, but the scoring is the same as for bowling.

Bowling with a Billiard Cue Combines Some of the Thrills of Both Sports in the Game of "Skill Ball," Which Is Illustrated

Radio Tube with Removable Heating Element, Which May Be Replaced When a Tube Fails

REMOVABLE RADIO FILAMENT REDUCES TUBE COST

Radio tubes with a removable heating element have been made by a woman radio engineer in order to reduce the cost of supplying tubes for the set. When a tube burns out, a fresh filament is inserted to renew the tube's usefulness.

ELECTRONIC BULLETS DESTROY GERMS PRODUCING BOILS

Electronic bullets, fired with electricity as low as thirty volts, are capable of killing at least one common form of germ, the mildest of the several that produce boils. In a study made at the University of Cincinnati, Dr. D. A. Wells found that the relatively low-speed electrons are deadly to the boil germs, it having been observed previously that high-speed electrons, driven by voltages of several thousand, have definite germ-killing effect. Electrons, according to one theory, are similar to forms of radiation like the ultraviolet rays which also kill germs.

RUBBER DOUGHNUTS SOLVE OIL-FIELD PROBLEM

Rubber "Doughnuts" Which Eliminate Friction between Casing and Tools in Drilling Oil Wells; a Spinning Auto Tire Furnished the Idea

Observation, plus inventive ability and pieces of rubber have solved one of the most stubborn problems of petroleum-exploration drilling procedure. Two years ago, a western inventor set out to learn why wet rubber slipped, and although he failed to some extent in the solution of that problem, he ascertained beyond a doubt that wet rubber does slip and, once convinced of that principle, he adapted it to a use which he knew existed. It was all brought about by watching the rubber-tired driving wheels of a heavily loaded truck as they spun round in a mud hole. Just how many people have watched the driving wheels of a truck lose their traction when they encounter muddy roads there can be no accurate conception, but, as this inventor saw the wheels spinning, he visioned another condition. Petroleum drilling requires that a steel pipe should revolve within another of somewhat larger diameter. The revolving pipe is attached to the drilling tools and the larger pipe serves to keep the earth surrounding the well from closing up the hole. Furthermore, water and mud are forced down through the revolving pipe and allowed to come up between the larger and smaller pipes, bringing the material loosened by the drilling tools with it. Since this particular process, which is almost universally used today, was first introduced some twenty-eight years ago, the ravages of friction between the revolving or drill-pipe and the larger pipe, known as the casing, have gone on unconquered. As the inventor stood watching the spinning motor-truck tires, he visioned drill pipe as it went around, also in mud. With two friends, he made up a crude sample but met with derision and discouragement everywhere. Finally, the first "rubber doughnut," as the device was dubbed, went into service at an oil well near Long Beach, Calif. The drilling crew were both skeptical and severe in the test they gave the device, but it worked, and so, by close observation of a most simple natural phenomenon, an inventor solved a problem which had baffled both scientific and engineering genius, yet, unheeded and unnoticed, other natural phenomena go on about us which are equally applicable and may be as productive of reward.

MANNA OF THE BIBLE IS FOUND TO BE DESERT SHRUB

Manna which the children of Israel ate during their sojourn in the wilderness came from the sap of a desert shrub, the tamarix, drawn off and predigested by insects and dried to hardness in the desert air, according to the conclusions reached by an expedition sent out by the Hebrew University of Jerusalem to investigate the question. There always has been a dis-

pute among scholars as to whether manna was an edible lichen, a low form of desert plant life, or was hardened sweet sap of the tamarix shrub. The expedition decided it is the same thing known elsewhere as "honey dew," the sap of the plant drawn off by aphids and exuded from their bodies. It is produced by one or two species of aphids on a single species of tamarix in sufficient quantity to form large drops that harden into sweetish grains of solid matter. Chemical analysis has shown the grains contain three varieties of sugar, as well as other compounds. The honey dew that turns into manna is formed from the downward current of sap that bears the food substances made in the leaves toward the roots of the plant.

TRACKS OF INVISIBLE RAYS SEEN IN MAGIC GLASS

"Glimpses of the invisible" are seen through a small glass window in a laboratory and classroom unit that brings evidence of the magic world of the radioactive materials, a realm that hitherto has been open to only a few investigators equipped with elaborate apparatus. The article somewhat resembles a microscope but, instead of looking into a lens, the observer peers into a cylindrical chamber, beneath the glass top of which is a short glass rod tipped with an invisible speck of a radioactive material. By pressing a rubber bulb, the chamber is partly filled with water; then, at the instant the bulb is released and the water recedes, an "explosion" of what appear to be tiny smoke paths shoots across the chamber. The effect is produced by the tiny particles that are constantly bombarded, at the speed of bullets, from the radioactive material. Releasing the water causes the air space in the chamber to expand. This results in a condensation of moisture on the ions produced by the particles as they shoot across the area.

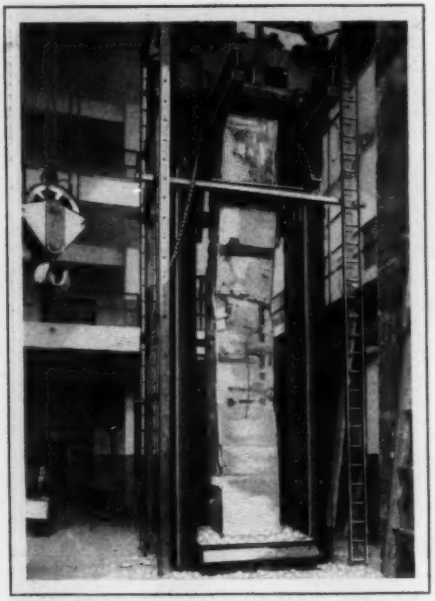
Firing the Flash and Releasing the Camera Shutter at the Same Instant by Improved Flash Gun

FLASH GUN OPERATES CAMERA SHUTTER RELEASE

Taking flashlight photographs is simplified by using a gun that has a cable release to operate the shutter at the instant the flash is fired. The two are said to be synchronized accurately, and the photographer has both hands free to manipulate the gun if necessary.

HAND TRACTOR PLOWS GARDEN AND MOWS THE LAWN

Equipped with a gasoline engine and tank for motive power, a hand-operated garden tractor is adapted to perform various garden tasks. It contains sprayer equipment for trees and garden, a full set of plows of various sizes and a harrow, and also may be attached to a lawn mower and utilized for other tasks about the home. All the implements are interchangeable, being attached or detached in a few minutes.



"Nutcracker" Which Tests Bridge Columns, and a Column Which Has Crumpled from Its Impact

"NUTCRACKER" TESTS METAL FOR BRIDGE COLUMNS

Capable of exerting 10,000,000 pounds' compression, a "nutcracker," the largest tester of steel columns in the world, is used by the bureau of standards to determine the strength of huge pieces of steel to be employed for various purposes. Recently the reinforced steel columns that will support the new Hudson river and Kill Van Kull bridges in New York were tested in it. It bent columns half the size of those to be used in the bridges, but it had to be exerted to the limit to affect any of the full-size supports.

HOW TRICKS OF SCIENCE UPSET MANY COMMON IDEAS

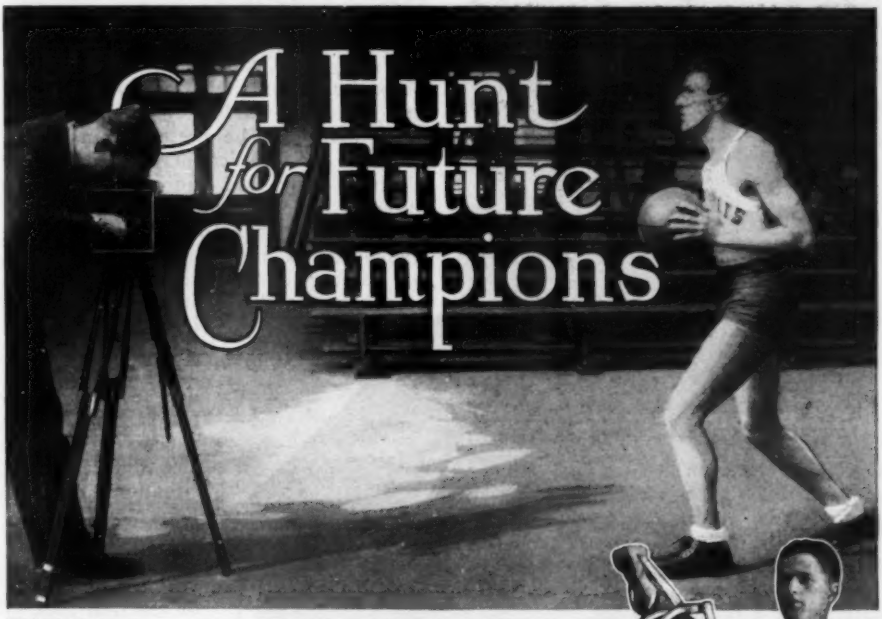
The average person might absorb a whole library of scientific works, yet the inborn conception would still remain with him that there would be light from a fire even in an unpeopled waste, and that a boiler factory going full blast would make some sound even in a world of deaf-mutes. Strictly speaking, however, there would be no light from the fire, nor sound from the boiler factory, for sound waves are silent until they strike an eardrum, and light waves are not light themselves; they are merely invisible vibrations in the atmosphere, conveying not matter, but energy to the eye. Light is merely a sensation within ourselves. Now take an ordinary lump of ice and hold it in your hand for five minutes. You will say that the ice is cold. You will find it hard to believe that there is any heat in the ice, but there is. Ice doesn't seem so cold, after all, when one discovers that it is hot enough to make liquid air boil. There are many mistaken popular notions relating to heat and cold. A woman with a fan has an idea that she is cooling the air. As a matter of fact, her fanning is making the air hotter, because it is being more rapidly passed over the human body, and is, therefore, absorbing more of the heat of the body. But the woman feels cooler because the heat is driven out.

SELF-FILLING LIFE-SAVING VEST KEEPS WEARER AFLOAT

Serving the purposes of a life belt, but without its cumbersomeness, a self-inflating life-saving vest which is worn like the ordinary garment now is on the market. The inside of the vest is of air-tight rubber material and has snap fasteners. Inflation is accomplished by jerking a discharge lever which releases air into the rubber chamber from a charged pressure tube. The garment, for use on boats or for fishing and duck-hunting trips, as well as for those learning to swim, will keep the wearer afloat on his back and does not interfere with swimming.

Life-Saving Vest Which Inflates Itself When the Wearer Pulls a Lever in Emergency

A Hunt for Future Champions

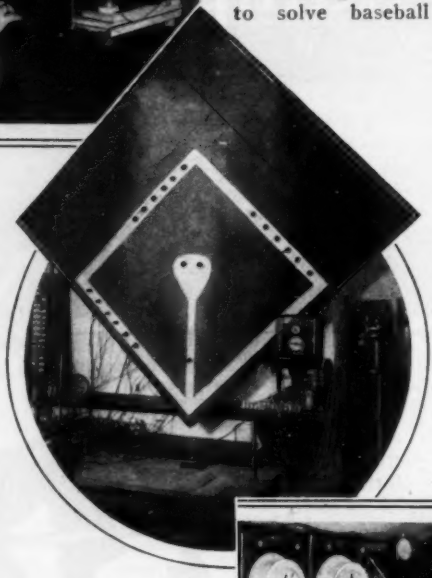


THRILLING acrobatics and polished athletic feats are performed at the University of Illinois, championship sports which are reproduced by the motion-picture camera and subsequently plotted and blueprinted—even as engineers solve railroad curve puzzles—in order that the muscular movements may be studied.

A seasoned gymnast gracefully and rhythmically turns a back somersault while the movie machine reproduces the act on celluloid film. A student, aided by a tumbling belt, then strives to duplicate the feat. After the negative has been developed and printed, the projection machine reproduces the movements of the two athletes on the screen.

Ordinary eyesight identifies the skill of the veteran and the faults of the novice as the slow motion picture is presented. The pictures are run slowly forward and backward time and again while investigators study the successive positions of the athletes. Deficiencies of movement

Making Movies of a Basket-Ball Player in Action, and Exercising on Eccentric Stationary Bicycle Used in Testing the Muscular Co-Ordination of Athletes



and faults in form are noted and the performer is shown his error and how to overcome it.

The motion-picture camera is an all-revealing eye which never lies. The baseball batter, pitcher, fielder and base runner can now be analyzed as never before. The secrets of the football player's success, the golfer's grooved swing, the diver's daring agility, the gymnast's gyrations, the shot putter's half turn, the hurdler's form and the sprinter's start and finish bare their former bafflements before this new system of photographic reproduction and dissection.

At Illinois, various other mechanical and electrified "sleuths" are being employed in the investigations of the qualifications of candidates for different sports. Not only are these devices used in ferreting out the peculiarities of individual students, but some of them are also yoked as silent teachers to train a man in certain of the finer points of the game in which he seeks to excel.

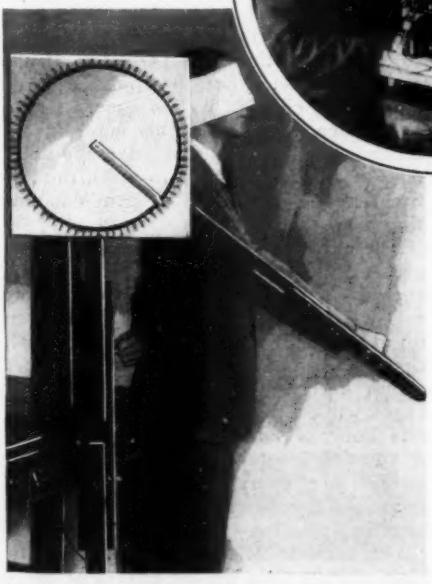
A case in point is that of an electrified baseball diamond and its midget players, suspended on the wall of Dr. Coleman R. Griffith's laboratory. There are some forty-two plays in organized baseball, so the story goes, and by means of a synchronous motor, similar to that employed in commercial window displays, these various plays can be presented in pantomime on the technical play board. These electrical plays are run at the average speed of major league baseball. The device can be used to test the baseball knowledge of the candidate as well as in training him to think quickly and to solve baseball situations as rapidly as they flash before his view. The player who undergoes this novel test is scored on his success in solving the different field situations flashed before him.

Various other testing devices reveal the mental lag, or reaction time of the students to different emergencies. All these responses to ringing bells, falling weights, flashing lights and

Top, Testing Vision with Lights; Center, Electric Baseball Diamond in Miniature, and, Bottom, Another Co-Ordination Test

out-of-position handles are timed by a delicately adjusted device which registers intervals as short as one one-thousandth of a second. Another interesting equipment keeps track of the athlete's time reactions to sound, light and pressure.

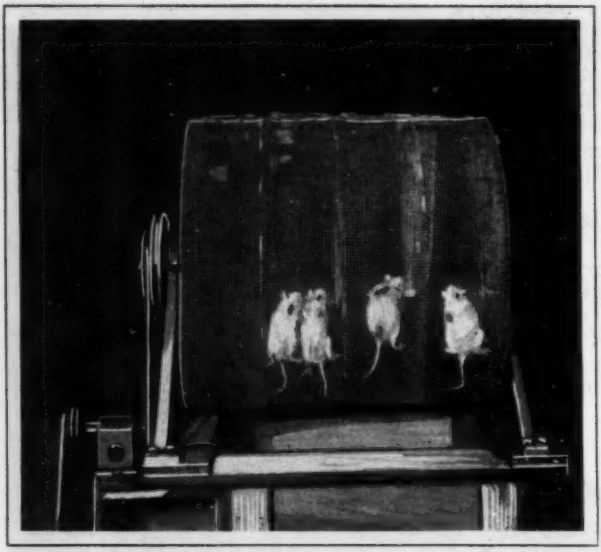
Involuntary muscular tremor naturally will affect the marksmanship of a trap-shooter, rifleman or archer, while it also collects its toll from other sports. Doctor Griffith employs a simple, yet very difficult, test, in detecting evidence of muscular tremor. The subject holds an electric pencil in his hand and stands at arm's length from a block of wood having three copper-lined holes in its surface, slightly larger than the diameter of the pencil. The subject seeks to plug the pencil into these holes in fairly quick sequence without touching the surface of the block or the sides of the apertures. A special recorder keeps tab on his efforts, while each time he touches the copper and completes the electrical circuit, a bell rings.



Top, Muscular Test; Center, Controls for Flashing-Light Set, and, Bottom, Apparatus for a Muscular Position-Memory Test

Then there is another device used in the presentation of "flash" or emergency situations. It consists of a large black screen with a small opening at one side. A wooden arm, which can be moved over a circular course, is so equipped that a picture of a football, baseball, basket-ball or hockey play can be attached and flashed through an opening in the black screen in the same interval that it would require on the actual field of play. It tests the ability of the athlete to size up plays and grasp vital situations as they develop on diamond, gridiron or court.

The Griffith eye-hand apparatus is devised to determine co-ordination of vision and manual action. The turntable of a talking machine is inlaid with eight circular spots. This turntable is wound up by means of a spring motor and operates at a normal speed of thirty-two revolu-



Rats in Rotating Cage, Driven by Electric Motor, to Test Effects of Exercise on the Animals' Ability to Learn

tions per minute when released. The athlete under test stands in front of the turntable. Its surface is covered with celluloid except one small wedge-shaped space. This space is just large enough so that three spots on the revolving disk are exposed simultaneously. The subject attempts to make contact with an electric point with each of these circles as they are exposed. The situation presented is similar to that which confronts the open field runner in a football game. He must watch the closest tacklers out of the corner of his eye and simultaneously must keep track of the players in front whom he must evade in his dash for a touchdown.

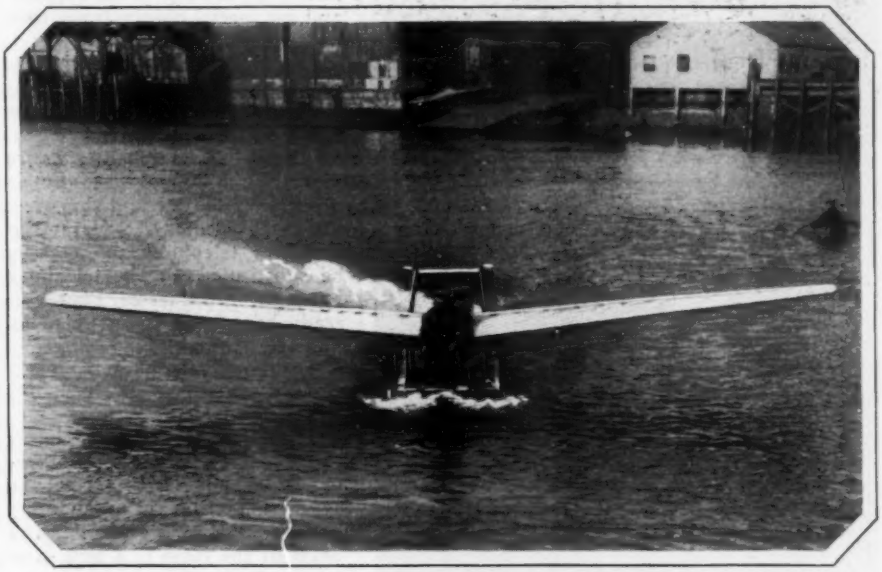
An unusual bicycle which you can ride indefinitely without accomplishing any forward progress is another novel appliance. The machine is so built that the pedals can be operated either together or separately in either clockwise or counterclockwise directions. Each terminal of the handlebars may also be turned in any direction. He who is tested for co-ordination on this machine can be ordered to execute an extensive series of movements. For example, the right foot may pedal backward while the left one is working forward simultaneously as both handlebars are being spun backward in unison. And just to prove that athletics develop muscular co-ordination, these tests have demonstrated that varsity athletes soon master the strange eccentricities of this stationary bicycle, while those unskilled in modern sports make poor showing when astride this steed of steel.

One of the most important experiments which Doctor Griffith is directing is a test with white rats to ascertain the effects of violent exercise on learning. The rats were first introduced to a simple problem—how to make their way from one end of a complicated maze to another in order to obtain food. A rat, when it is first placed in the maze, will, as a rule, require anywhere from thirty minutes to four hours to negotiate the trip. On its arrival at the opposite outlet, the animal is given a piece of cheese. When the rats gain experience, they travel this maze in ten seconds. All rats run the maze five times daily until they are able to make the trip five times in succession without committing a mistake.

These rats are divided into experimental groups, each animal being identified by special ear notches and dye stains. The rats which compose one group are given no exercise, living in wire cages so small that they can barely turn about. Another group exercise as they desire in large cages, while a third group are subjected to one hour of enforced exercise daily in a rotating motor-driven drum. Other groups are exercised, respectively, for three and five-hour periods daily in this electric exerciser.

This remarkable research is expected to yield definite data on the effects of exercise on the faculty of learning, a moot question which, heretofore, has defied scientific solution.

BOAT WITH WINGS DRIVEN BY OUTBOARD MOTOR

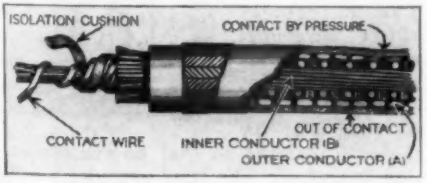


A "Waterplane" Equipped with Wings to Allow It to Skim over the Surface, and Powered with an Ordinary Outboard Motor; It Attains a Speed of Sixty-Five Miles an Hour

Equipped with wings and driven by an outboard motor, a craft called a "waterplane" has been built by two Californians, and in tests attained a speed of sixty-five miles an hour. The boat is powered with an ordinary racing motor, and the long wings help to lift it out of the water without actually carrying it into the air.

PRESSURE ON ELECTRIC CABLE SERVES AS SWITCH

Pinching a cable at any point throughout its length, to make an electric contact to operate any device to which the cable is connected, is possible with a novel electric wire cord now being produced. The apparatus consists of a water, dust and acid-proof cable the size of a lead pencil. Two conductors, inclosed by the outside insulation, are left bare but separated from each other by a cushion of rubber. Pressure applied to the cord at any point causes the rubber to yield and brings the outer conductor in contact with a wire which is always in contact with the inner conductor, thus closing the circuit as long as the wire is pinched, and making the cable one continuous switch. The contact-control cable may be used to operate electric switches, lights or radios, as a signal of a holdup in banks, in mines as a signal of danger or call for aid, and also in automatic traffic control.



Cross Section of Cable Which Makes an Electric Contact When It Is Pinched at Any Point

CREEL KEEPS CONTENTS FRESH

Capable of keeping fish fresh and unspoiled for more than forty hours, a ventilated creel has been invented by a Salt Lake City man. It is made of canvas with a rubberized lining and is reinforced on the outside with leather. In appearance it is like the ordinary creel. The container may be turned inside out for cleaning and drying.

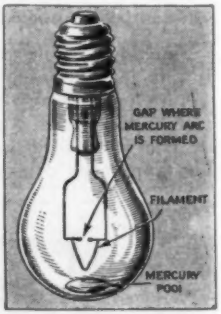
Observation Car Attached to Dirigible from Which Observer May Direct Flight of Craft in Fog above Him

OBSERVATION CAR IS HUNG BELOW AIRSHIP

Remote control and guidance of a dirigible through instructions telephoned the crew by an observer stationed in a car suspended from the airship, have been successfully accomplished in tests by the air corps of the United States army. The compartment in which the observer sits is known as the "sub-cloud observation car" and makes it possible to fly a dirigible through clouds, while the observer, stationed in the car below the clouds, governs the flight by directing the crew above him by the telephone set connecting car and dirigible. The idea dates back to world-war days when such observers often were lowered from attacking blimps, but the air corps hopes to convert the plan to peace-time uses. The observation car lends itself particularly to assisting an airship to land in fog, and for special observations, such as air photography. The car is lowered by a cable and windlass and is so designed that the rear end acts as an automatic rudder to keep it from revolving. Possibility is seen that the entire flight could be governed by an observer if the car and ship were radio-equipped, and radio telegraphy or telephony could easily be substituted for the telephone sets used in the tests. Planes already have been flown by radio.

LAMP GIVES SUN BATH HARMLESS TO EYES

Giving light of a quality closely approximating sunlight, but requiring no goggles to protect the eyes from the rays, a mercury health lamp now is available. The heart of the lamp is a bulb containing both a filament and mercury-arc generator. When current is passed through it, the filament becomes heated and in turn heats a pool of mercury in the bowl of the bulb. The mercury vapor rises and creates an arc across a tungsten gap whose electrodes project from the filament supports. The lamp is burned with the base up and requires a current regulator, consumption differing when arc and filament burn separately and together. When used with the proper reflector, the lamp produces light containing both infrared and ultraviolet rays. The extremely short ultraviolet rays likely to affect the eyes, however, are screened out by the bulb material so that no eye protection is needed. The lamp provides a brilliant illumination.



ALLIGATOR SHIPS CLIMB HILLS AND HAUL LUMBER

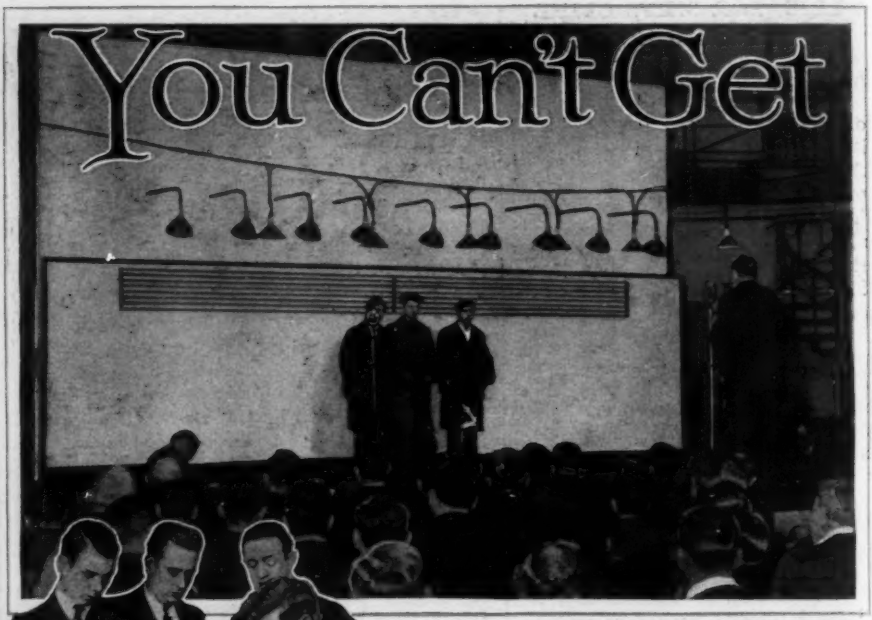
Up in the far northern woods of Ontario, the "alligator" does its busy day's work in starting the logs on the trip downstream to the mills. Like the saurian from which it takes its name, the alligator of the lumberman is thick-skinned and can navigate on land or water. One of them, recently launched, climbed over a hill from the shipyard, plunged into the river, where it paddled along until opposite the railroad siding, where it climbed up the bank and finally hoisted itself aboard the two flat cars that were to bear it away to duty in the northern lumber camps. These tugs are built in various sizes, from thirty-seven to seventy feet in length, in either paddlewheel or twin-propeller type. They draw but thirty inches of water and are shod on the bottom with heavy steel runners. The propeller type is built with a flexible joint in the shaft so the screws will rise when meeting any obstruction, with heavy skegs to guard them from striking logs or rocks, and the rudder is hung on a hinge, so it will lift when going over logs or booms, then drop back to its former position. The boats are equipped with warping gear and double drums carrying a mile of steel cable and are powered with a sixty-horsepower marine steam engine. The fact that the alligator's power plant is small, does not handicap it in towing work, which is done in a unique fashion. Instead of towing the logs outright, the alligator, its cable hitched to a boom and unwinding as the boat moves, proceeds for about a half mile, when the anchor is let go or the boat is made fast to a tree. Then the cable is wound in, and in this manner the alligator is capable of hauling a boom of 60,000 logs at a time. In making a portage overland, logs or skids are placed under the runners, the cable fastened to a tree ahead, the winch started and the alligator climbs up or down hill, through swamps, bogs or underbrush to the next river or pond, where rollways or skidways may be constructed, the whole procedure effecting a considerable saving in time and men.

"Alligator" Boat That Navigates Land as Well as Water by a System of Skids and Cables Attached to It

ANCIENT CHINA HAD TALKIES

More than 100 years before the Christian era, a form of talking pictures with motion originated in China and has continued popular to the present day. This is the shadow play which gives the illusion of moving pictures, while the "talkie" effect is supplied by persons who read the parts of the drama

You Can't Get



Police Viewing Suspects for Identification, and Coroner Herman N. Bundesen of Chicago Testing Machine-Gun Bullets

By JOHN F. COGGSWELL

JUST a few weeks ago, an eastern man, convicted of slaying, was executed in the electric chair. Before the trial, he thought he had a defense that would arouse doubt in the mind of any juror, but it collapsed before evidence brought out by the photomicrograph camera, which, as an instrument for the detection of crime, is fast becoming a veritable Nemesis to wrongdoers.

The defendant had been a long-term convict in the Massachusetts state prison. He became possessed of a revolver of the same caliber and type as those carried by the prison guards. One Sunday, while the convicts were returning to their cells after chapel exercises, the young prisoner attempted to shoot his way to freedom. Two guards returned his fire. One of them fell mortally wounded. The other winged the convict, who was subsequently subdued and disarmed. Shortly afterward, he was placed on trial for murder. His lawyers maintained that the guard was killed, not by the convict, but by his brother guard. They prepared charts, showing the position of each of the three combatants and demonstrated the possibility of their contention.

Then appeared one Wilbur F. Turner, an expert on guns and their ammunition, knives, handwriting, fingerprints and other details of criminal investigation. He submitted several photomicrographs taken by a camera equipped with a series

Emergency Squad, Attending Police College, Equipped with Gas Masks, Firing Tear-Gas Pistols Developed to Curb Criminals; the Weapons Are Effective at a Surprising Range

of lenses having the power to make, directly from the subject, pictures magnified anywhere from ten to several hundred diameters.

Turner's photomicrographs showed, side by side, the mortal bullet and missiles from the surviving guard's and the convict's guns, these being test projectiles fired after the crime. In these greatly magnified pictures the revolver bullets appeared nearly as large as those from small cannon.

The reproductions showed that the fatal bullet had been fired from a gun, whose rifling had a right-hand twist. The test projectile from the convict's gun showed this same direction of twist, but the guard's was exactly opposite—a left-hand twist. Furthermore, the test bullets from the convict's gun displayed certain characteristic markings, the beginnings of them also easily discernible on the mortal bullet, even though its nose had mushroomed somewhat. Markings on the test bullets from the guard's gun were entirely different.

In short, the photomicrographs proved conclusively that the fatal shot could not have come from the guard's gun and did come from the convict's, so the defense crumbled and he went to the chair.

On bullets discharged from them, gun barrels leave markings as individual as are fingerprints. Two or two hundred projectiles fired from the same gun will show the same characteristics. On the other hand, bullets from different firearms—even though guns and ammunition are of the same caliber and make—are always marked differently. Infinitesimal flaws in the steel, variations of one ten-thousandth of an inch in the lands and grooves of the rifling, show up plainly visible in the photomicrographs of the projectile.

On the slope of a hill, close by the Canadian border, was found the body of an aged man, shot through the head. The murderer had covered the body with brush and bushes cut near by. Close to the corpse lay the victim's hat, two bullet holes through the rim. In the road below, stood his automobile.

The slain man and a farmer, upon whose place he held a mortgage soon due, had been seen to enter the car together and start up the road on which the machine was found. The farmer was suspected

of the crime and was taken into custody. The state's attorney called the expert criminologist into the case. The expert viewed the body, paying particular attention to the wound and a fragment of a bullet that had been probed from it. Then, taking the hat with him, he went to the scene of the crime. Obviously, the man had been slain where the body was found; the blood and the condition of the ferns and bushes proved that.

Imbedded in the bark of a near-by tree, Turner found a soft-nose bullet, part of it missing, its lead nose badly distorted, but a narrow strip of the steel jacket around the base still intact. It gave evidence of having passed through flesh before striking the tree.

After a careful survey of the scene, the expert gathered up some of the pieces of brush that had covered the body and broke off a few of the stubs from which they had been cut. These, with the hat and the bullet, he carried to his laboratory. The discharged shells could not be found.

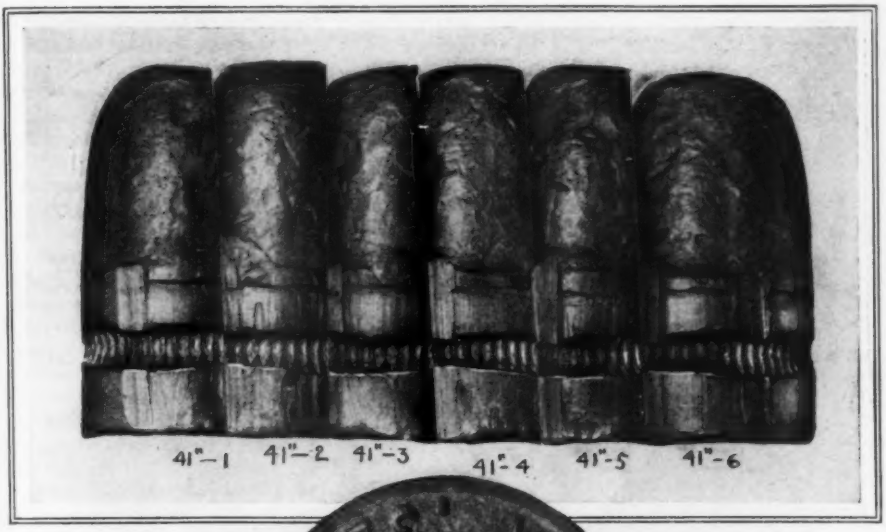
The victim, he reported a few days later, had been climbing up the hill. A rifleman, some distance down the slope—at a point about sixteen feet lower vertically—had fired two shots at the mounting figure. The first was a miss and penetrated the rim of the hat. The startled man had ducked and turned to see who was shooting at him, when the second shot, fired closely after the first, killed him.

The slayer had used a .32-caliber rifle, likely a .32-40, using smokeless powder. He was an expert shot in spite of his first miss. He possessed a large clasp knife that had been sharpened with a file. And he was left-handed. Subsequent developments proved the criminologist right in every detail.

Simple reasoning, a keen eye for angles, a set of accurate scales and the photomicrograph camera had given him the whole story. A Marlin .32-40 rifle, together with two empty shells and a part box of loaded ones, was found in the home of the accused man. A heavy knife, the marks of a file on its blade, was among the possessions taken from him when he was jailed. In addition, he was known to be left-

Photomicrographs by Wilbur F. Turner

Loading Tear-Gas Bombs, and Two Important Photomicrographs; the Center One Shows Ridges in Severed Brush End That Figured in Murder Case, and, Below, the Marked Knife Blade That Made the Ridges



Photomicrographs by Wilbur F. Turner

Above, Composite Photomicrograph of Six Sections of Entire Circumference of a Bullet; Below, Sectional Method of Studying and Comparing Shells

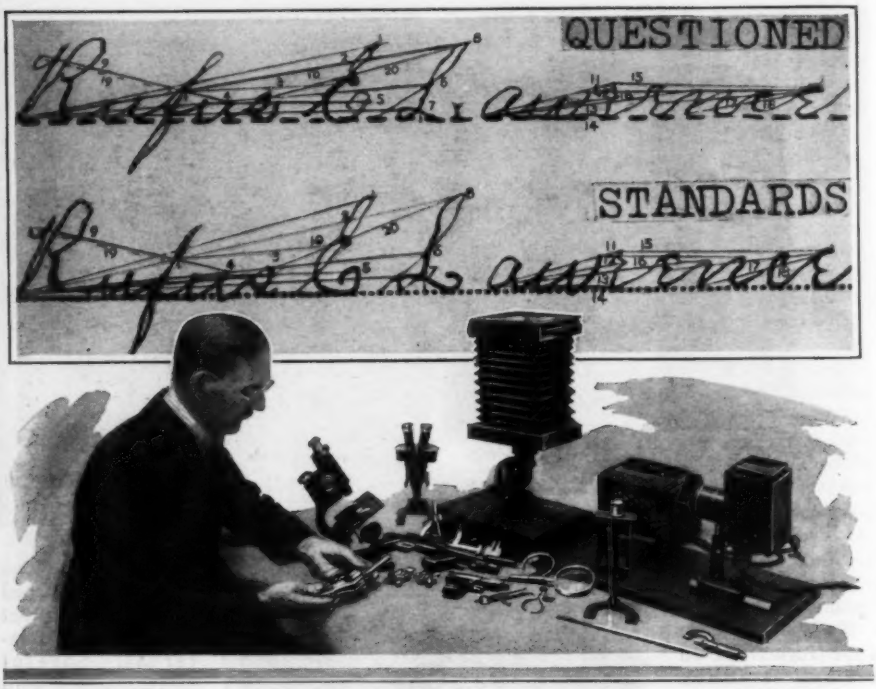
handed. His prowess as a hunter was legend.

Knife and rifle were forwarded to the expert. Back came his report that the rifle was the one that had fired the bullet found at the scene of the crime, and that the knife submitted was the one which had severed the saplings that covered the body. How could he possibly have arrived at these conclusions?

The murdered man's hat brim had been turned up at the back and front. Photomicrographs of the two holes in the brim showed, by direction of entry and exit, that both had been made by the same bullet. It had entered from the back and left through the front. The angle showed that it had been fired from a point directly behind the victim. The second shot, however, had entered his right eye and emerged through his left ear. Evidently, the man had not turned quickly enough to face the killer before the second shot had crashed home. None but an expert marksman could have ejected the empty shell, pumped in a load and sped off the fatal bullet in such a short interval. Careful measurements and weighing of the recovered bullet and the fragment from the wound, had disclosed its caliber. Comparative photomicrographs of the rifling markings upon it and those upon a test bullet, fired after receipt of the gun, linked the farmer's firearm and the mortal projectile.

Photomicrographs of the severed ends of the brushwood showed certain ridges in the wood—common to all—that had been left by minute nicks in the cutting blade. But the knife would have to be keen and heavy to sunder, at one slash, brush of the size cut. Logically, the nicks were not from use but from a sharpening device—hence a heavy knife sharpened by a file.

Anyone possessing a knife with a good-sized nick in the blade, can see for himself how the expert discovered that the slayer was left-handed. The ridge left in the



Photomicrograph by Wilbur F. Turner

The Upper Signature Is an Excellent Forgery of the Lower; Note Angles Drawn to Compare the Two; Below, an Investigator with Photomicrograph Camera and Other Aids Used in Detecting Crime

wood by the nick will slant to the right, when the knife is held in the right hand and to the left if held in the left hand. In the case under consideration, the nicks were too small to produce ridges visible to the naked eye, but the photomicrograph camera made them apparent. Furthermore, when a reproduction of the knife blade—magnified to the same diameter—was placed against the magnified view of the cut ends of the brush, nicks fitted ridges precisely.

In the famous Sacco-Vanzetti case, a photomicrograph of the cap end of a discharged shell, found on the scene of the payroll robbery and murder, showed a flaw in the indentation made where the firing pin had hit the cap. The keen eye of the magnifying lens showed a corresponding nick in the firing pin of a revolver involved in the case—an important link in the evidence.

The most expert forgeries lose their resemblance to the genuine when both are displayed side by side in their magnified form. Discrepancies in the size and form of letters and the angle of the script become evident.

The work of the best chemical-ink eradicator is exposed when an altered document is placed before the photomicrograph lens. Raised checks and notes, and modified clauses in legal papers, such as wills, are quickly proved fraudulent by the keen eye of the camera.

All of which gives additional weight to the old saying regarding crime: "You can't get away with it."

MONEY IN WALRUS WHISKERS REVEALED BY TAX REPORT

Queer occupations are listed by census officials. Among them is described the odd occupation of "Cinder Ella," an old woman who goes about the Wall street district of New York, earning small fees by removing dust from the eyes of the

brokers. In Virginia, there is a young woman who makes a fine living collecting shells on the beach and coloring and carving them as souvenirs. The occupation of tea taster is no longer unusual, nor is that of the professional ham smeller, who sticks a skewer into a ham in the meat-packing plant and can tell at once whether it has soured around the bone. It was an income-tax report that brought to light the profession of collecting and selling walrus moustaches. The collector, a resident of San Francisco, turns over a profit of $7,000 a year in this business. When the government officials read his report, they became curious to learn about his market. He explained to them that among the Chinese in America there is a great demand for the bristles, which are made into ornamental toothpicks by Chinese artisans and sold for curiosities, gifts or souvenirs. But the occupation of time selling by an individual is a new one to this country. Americans can buy the correct time in almost any city by calling up the telephone or telegraph company. In London, however, in the industrial section, the correct time is purveyed by an old woman. She has London's quaintest job. Every day she visits the Greenwich observatory and sets her famous old watch, which is more than a century old, and which was once owned by the Duke of Sussex. This watch, it is said, keeps perfect time. When she has had it set she returns to make her rounds.

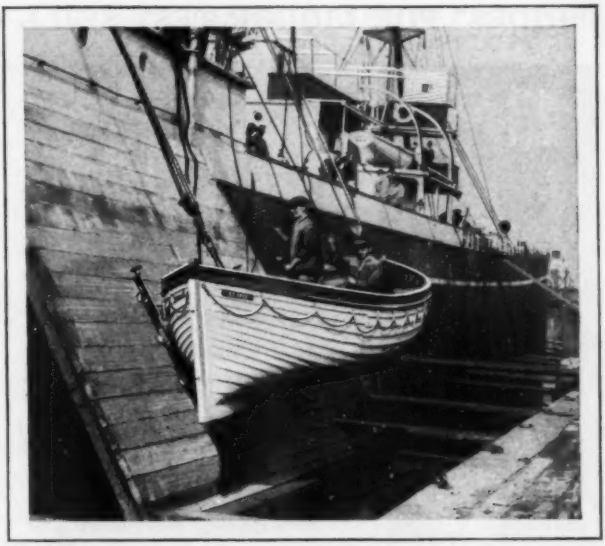


Photo Topical Press

Traveling Skids on Rollers Attached to Lifeboat Which Prevent the Boat from Overturning While Being Launched as a Ship Lists

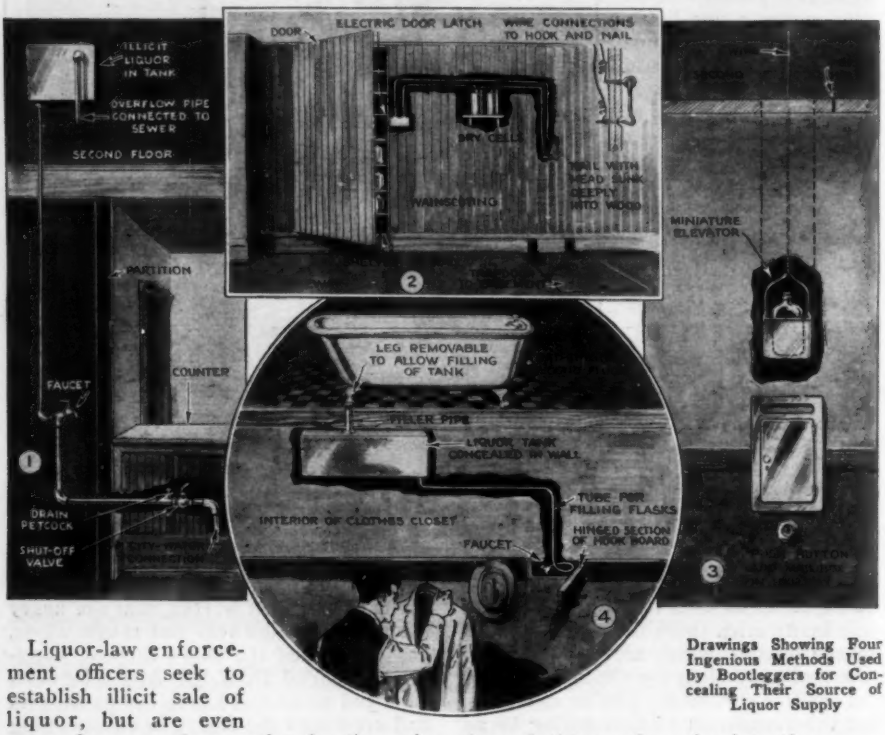
SAFE LAUNCHING OF LIFEBOAT ASSURED BY SKIDS

To save life and avoid the frequent tragedies occurring when a lifeboat is launched down the side of a wrecked liner's hull listing at a dangerous angle, a device was recently demonstrated in the port of Cardiff, South Wales. It has happened in the case of recent wrecks, that the heavy list joined to high seas and rough winds, has overturned the ship's lifeboat, hanging suspended from the davits between wind and water, and has spilled passengers and crew into the raging seas, drowning even the strongest swimmers. By the new device, the lifeboat has two traveling skids, with caster wheels attached to its keel by the bow and aft. When the sinking ship is listing too heavily for the lifeboat to be launched in the ordinary way from the davits, a strong rope and pulley are attached to the davit on the deck of the liner and connected up with the bow of the lifeboat, which is then slid on the traveling skids down the sloping hull.

THIS SHOTGUN HAS ONE BARREL ON TOP OF OTHER

Double-barrel shotguns with one barrel on top of the other, instead of beside it, are being placed in production as the result of the invention of a Utah man. The gun with its superimposed barrels has but one trigger which fires one barrel at a time. It is intended primarily for sporting purposes.

"HIDES" FOR LIQUOR TEST SKILL OF DETECTIVES



Drawings Showing Four Ingenious Methods Used by Bootleggers for Concealing Their Source of Liquor Supply

Liquor-law enforcement officers seek to establish illicit sale of liquor, but are even more keen to locate the bootlegger's "hide"—the place where he secretes his supplies. Many of these hides indicate real mechanical ingenuity. Illustration No. 1: Enforcement officers call this the most ingenious hide that they have unmasked. It embodied the two prime essentials desired by purveyors of illicit beverages. First, the liquor, although stored at a point remote from the place of sale, was easily accessible to fill orders, and, second, it could be disposed of quickly in case of a raid. When the shut-off valve was closed, the water from the upstairs tank and the connecting pipe flowed off through the drain petcock, which was afterward plugged. Then the tank was filled with liquor, which was drawn off into flasks through the faucet behind the partition. In the event of a raid, the shut-off valve was opened, allowing the city water to rush up through the pipe into the tank, carrying the liquor before it out through the overflow pipe into the sewer, whereupon the faucet ran clear water instead of liquor.

Illustration No. 2: Raid after raid failed to reveal the hide in a city drug store, where officers were certain illicit liquor sales were being made. Connecting the main store with a stockroom in the rear, was a narrow passageway, both walls wainscoted from baseboard to ceiling. Part way down the passage was a trap-door, held up, when open, by a steel hook, screwed into the wainscot. A nail had been driven through the boards, its head imbedded deeply in the wood, in such a position that the point of the hook could just touch it. Wires connected the end of the nail and the screw of the hook with a pair of dry batteries and an electric door latch, concealed behind the wainscot. Making contact of the point of the hook and the head of the nail closed the circuit and released the latch, allowing

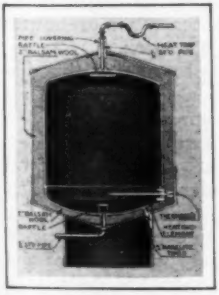
a section of the boards to swing out. Behind the section were shelves, stocked with illicit liquor.

Illustration No. 3: A customer of a bootlegger, located on the second floor of an apartment block, signaled the liquor dispenser by pressing the electric bell button in the corridor. If inspection, from a peephole drilled through the floor and ceiling, revealed that all was well, the illicit purveyor lowered a miniature elevator box down a shaft concealed in the wall and connected with the mail box. Opening the door of the box, the customer placed a bill in the elevator, which on its return trip carried down to him a filled flask.

Illustration No. 4: Opening off a small restaurant, was a clothes closet, every hook in which was hung with various pieces of wearing apparel. A small section of the hook board could be swung outward. In a recess, behind the section, was the end of a tube, fitted with a tiny faucet. From it flasks were filled, on order, with liquor stored in a copper tank concealed in the wall. The pipe through which the tank was filled was concealed beneath a removable leg of the bathtub located on the second floor.

ELECTRIC HOT-WATER HEATER FOR THE FARM HOME

Designed particularly for rural and suburban homes, wired for electricity but without modern means of obtaining a supply of hot water, an electrically operated hot-water tank now is on the market. The tanks, of sixty or 120 gallons capacity, are covered with balsam wool, the heating elements being so arranged that they may be removed without disturbing the plumbing. The elements are not affected by hard water, and tests have shown operation of the heater is possible at moderate cost, while the first cost compares favorably with other plants.



UMBRELLA WITHOUT A FRAME FOLDS LIKE ENVELOPE

Umbrellas without frames that fold like an envelope so they may be carried under

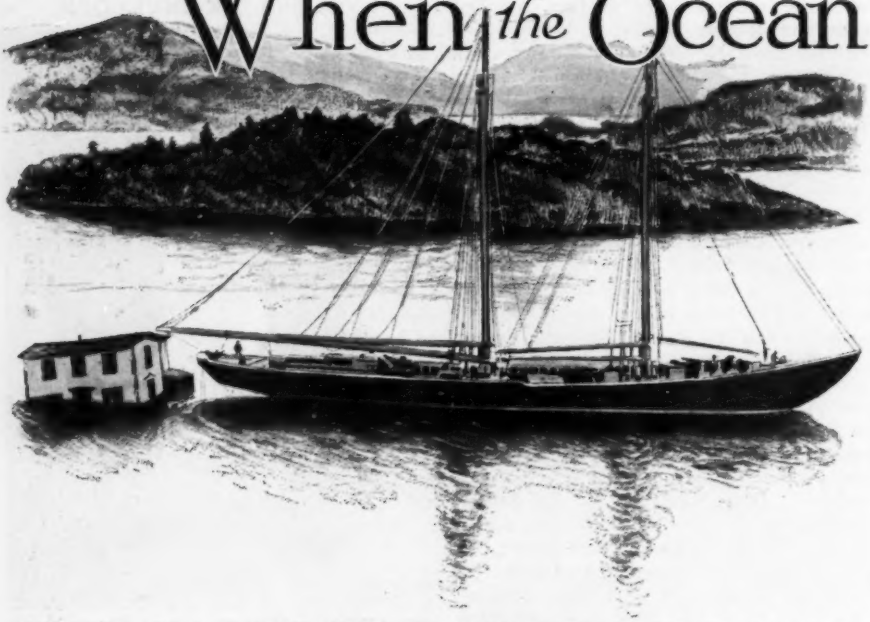
The "Umby," an Umbrella without Ribs or Handle, Which Folds Like an Envelope for Carrying

the arm or in the pocket when not in use, are handed out to patrons of a chain of New York theaters on rainy days. The rain protector, known as an "umby," has neither ribs nor handle, is made from a material which turns water, is set on the head and held in place with the hand. It covers head and shoulders and, when in use, somewhat resembles the newspaper frequently employed by persons caught in a sudden shower.

TALC USED FOR FACE POWDER HELPS KILL GRAIN PEST

Talc, which is the base of face powders, assumes a new role in the campaign of science against a disease that destroys barley. Iowa state agricultural-experiment station workers are employing it in the manufacture of a dust applied to combat the disease. The talc is the carrier for a poison mixture which is composed of bicarbonate of soda, sodium bisulphite and other chemicals calculated to check the spreading of the pest.

When the Ocean



Fishing Schooner Towing into Harbor a Two-Story House Which Had Been Swept Five Miles Out to Sea by the Recent Newfoundland Tidal Wave Which Took a Toll of Many Lives

By CHARLES FITZHUGH TALMAN

AN EARTHQUAKE strong enough to cause some alarm, but not to do any immediate damage, shook New York state, New England and eastern Canada late last fall. Records of this quake were obtained by seismographs at points as far distant from one another as Victoria, B. C., Tucson, Ariz., and West Bromwich, England. The reports from these places and others, promptly collected by international arrangements, were examined and the center of the disturbance located under the Atlantic ocean about 120 miles south of Newfoundland.

An interesting sequel of this event remained unknown to the world at large for three days. Owing to a local interruption of telegraph service, it was not until several days later that press dispatches reported the occurrence of a destructive tidal wave along the shore of the Burin peninsula, in southern Newfoundland, causing loss of life and much destruction.

What happened in that region for the first time in its history has often happened on seacoasts in other parts of the globe. The ocean suddenly invaded the land in a series of great waves, which, crowding into narrow inlets, rose forty to fifty feet above the normal level of the sea. Many ships were wrecked, buildings were lifted from their foundations and some were carried out to sea as the waters receded. A serious blow was dealt to the fishing industry upon which the locality depends for a livelihood, as the waves destroyed boats and tackle and swept away storehouses containing the season's catch.

The scientist will tell you that this disaster was not due to a tidal wave. In a narrow and proper sense of the term, a tidal wave is one of a somewhat complex series of waves that constantly travel around the globe under the gravitational pull of the moon and the sun, causing the waters on our coasts to ebb and flow twice a day. These moderate upliftings of the ocean surface are so gradual in their slope

Floor Quakes

Cutting a Broken Cable with Hacksaws before Heaving the Ends Aboard for Testing; Grapnels Are Shown Suspended from the Bow Sheaves

that they bear no resemblance to waves except in the diagrams published in reference books.

For the present purpose, however, we shall follow familiar usage and describe as "tidal waves" the occasional upheavals of the ocean and inundations of the shore that occur without any relation to ordinary tides and are often very disastrous in their effects. They appeal to the imagination of mankind, because, in many cases, they arrive in calm weather and their cause is not obvious to casual observation, but there is no real mystery about them. They are sometimes produced by storms, near or distant; sometimes by earthquakes, and occasionally by volcanic outbreaks under the sea.

It is not a sufficient explanation of the recent tidal wave in Newfoundland to say that it was due to an earthquake. Many severe earthquakes under or near the ocean are followed by no marked disturbance of its waters. It is only when a quake causes a subsidence of the sea bottom over a considerable area that the resulting displacement of a large body of water sets up waves at the surface. The first effect of subsidence is an inrush of water from all sides, which explains the withdrawal from near-by shores that is often observed to precede an earthquake. When the inflowing currents meet over the place of subsidence their impact raises a mound of water that is, so to speak, the parent of the tidal wave. When this mound collapses, waves spread out from it in an ever-widening circle, flowing over neighboring shores. The mound gives place to a depression, the waters flow in again, and the process is repeated until equilibrium is restored.

The sinking of the sea bottom that produces such waves is due in some cases to slipping along a "fault," such as is often observed in earthquakes on dry land, when the ground on one side of a break drops many feet below its previous level. Other subsidences under the sea consist of landslides along the steep faces of gigantic submarine cliffs. Many such cliffs are well known to hydrographers and others are constantly being discovered through the rapid survey of the ocean floor now being carried out by acoustic methods of sounding.

That there was a considerable sinking of the ocean bed in the November earthquake is proved by the fact that the trans-

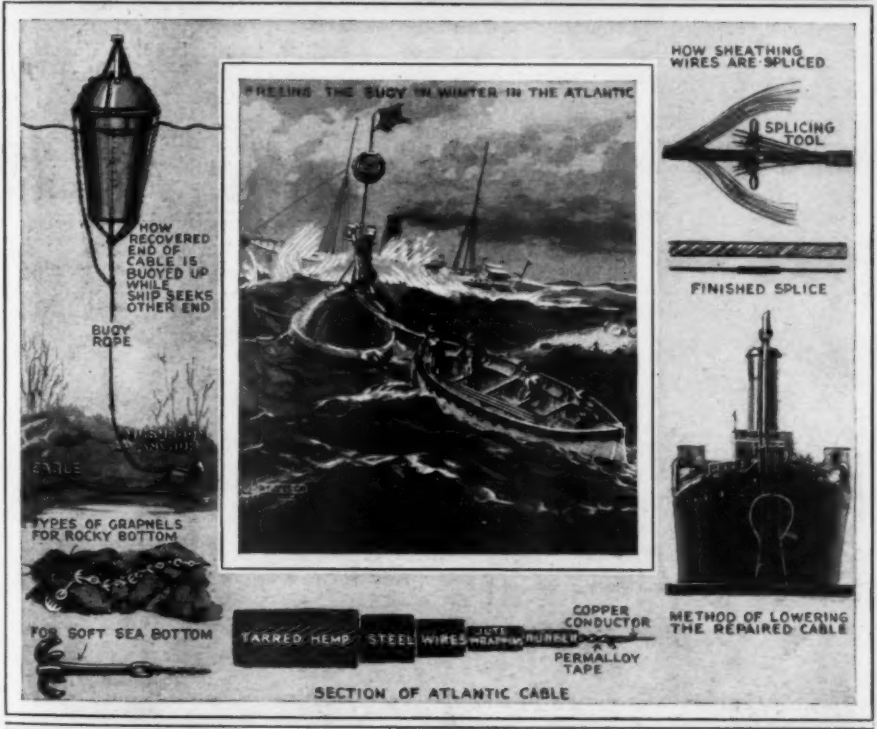
atlantic cables broke at several points at the time of the shocks. The location of these breaks corresponds in a general way with the western border of the deep channel leading out of Cabot strait. Here the shape of the bottom is favorable to the occurrence of extensive landslides under the shaking of an earthquake, and, pending further investigations, it may plausibly be assumed that such slides caused the tidal wave.

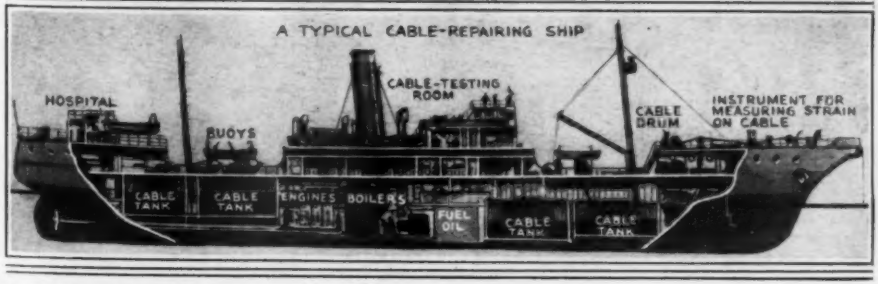
Submarine cables are often broken by earthquakes, and the location of a break can be promptly determined on shore by a process that consists in measuring the electrical resistance of the line up to the point where it has parted. Thus there is little delay in getting a repair ship to the spot and restoring service. This information does not help in locating the earthquake itself, because the subsidence causing the break may occur hundreds of miles away, but it does indicate the point of origin of the tidal wave, and thus it might, in some cases, make possible the issue of timely warnings to the inhabitants of coasts likely to be engulfed.

Top, Rigging On a Mark Buoy of One of the Veteran Cable-Repair Ships; Below, Repairing a Broken Cable After It Has Been Raised

The feat of predicting a tidal wave in time to save life and property has already been accomplished. At the Hawaiian Volcano Observatory on the morning of Feb. 3, 1923, the earthquake recorders in the basement told of a quake 2,000 miles away. Doctor Jaggar, the director of the institution, knows the Pacific well and he realized that big waves from the disturbed area would roll across to the Hawaiian shores. Warnings were sent out by tele-

THE CABLE SHIP PROCEEDS TO THE SPOT
RETRIEVED END ATTACHED TO BUOY
FINALLY THE TWO ENDS ARE JOINED AND THE CABLE TURNED TO THE SEA





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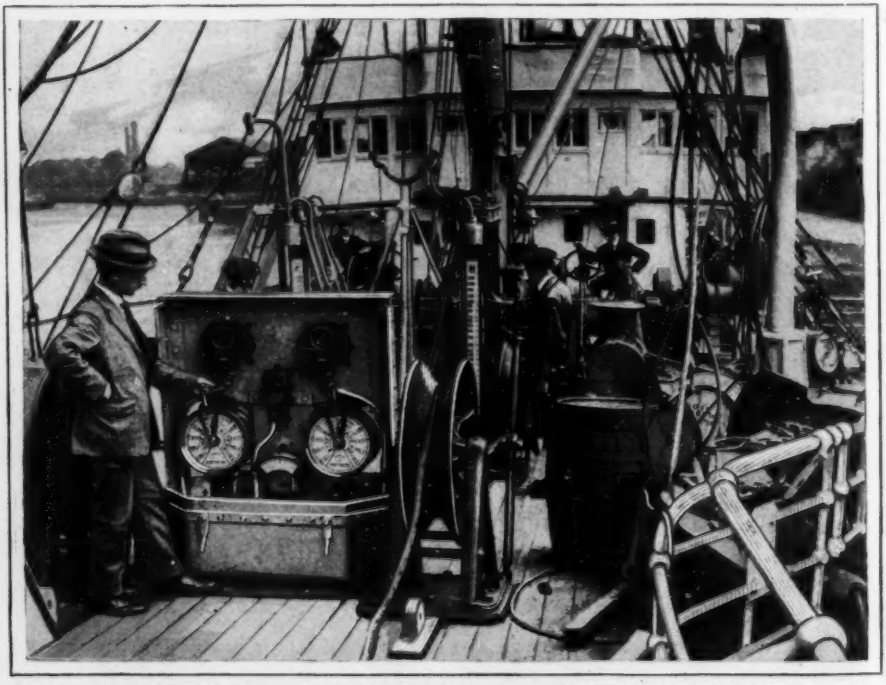
phone. In the early afternoon the tidal wave arrived. It washed sampans over the railroad bridge at Hilo, wrecked the latter and killed one man, but the disaster was small compared to what it would have been if no warning had been given.

The Lisbon earthquake, of 1755, was attended by the most celebrated tidal wave in history. The center of the quake was under the Atlantic. The shocks threw down almost the entire city, but a large proportion of the loss of life (variously estimated at from 20,000 to 100,000) was due to sea waves. When the quake began, the water retired from the land to such an extent that the bar at the mouth of the Tagus was left completely bare, but it returned a few minutes later as a series of waves, the first of which was sixty feet in height.

The great earthquake that destroyed the city of Lima, Peru, on Oct. 28, 1724, was accompanied by a huge tidal wave at the neighboring port of Callao, where the water first receded and then returned as a wave eighty feet high. Nineteen ships were sunk in the harbor.

Volcanic eruptions and uprisings under the sea sometimes cause tidal waves, but, on the other hand, the most gigantic outbreaks from craters above sea level and close to the ocean usually leave the latter undisturbed. The tidal waves that frequently flood low shores during the passage of severe storms are due chiefly to the mere force of the wind, but partly also to the elevation of the ocean surface at the storm center under the diminished pressure of the atmosphere, and partly, in the case of the relatively small cyclones of the tropics, to the heaping up of the water by the convergence of the winds toward the center. As the winds may blow at high speed around the center while the storm as a whole moves slowly, the waves produced by the winds frequently travel far beyond the storm area. Thus it happens that a rising sea is a usual premonitory sign of an approaching tropical hurricane.



Equipment on the Deck of a Cable-Laying Ship Which Controls the Paying Out of a Cable, a Task Requiring Much Skill and Care

STUDENT AVIATORS FLY BLIND

Just as typists are taught to write by touch, so students in some French flying schools are learning to fly entirely by the "feel," or sensation obtained from looking at the instrument board. The student flyer's compartment from the beginning is completely hooded, the instructor communicating with him by phone from another cockpit when he makes an error. One student on his ninth flight became hopelessly lost in clouds while flying by personal impression after learning to fly by feel, but quickly overcame his difficulty when he reverted to the instrument method.

Rotary Grader Used to Reclaim Farm Lands Laid Waste by Floods; the Shovels Move at Right Angles to the Path of the Machine

THUMBTACK REMOVED EASILY BY TWISTING HEAD

Thumbtacks that are pushed into position, but twisted out easily now are on the market. The tack has two slots in the flat head for the nails of the thumb and forefinger to secure a twisting leverage. Removing the ordinary tack often results in damage to valuable drawings as well as loss of time, both these objectionable features being eliminated with the new tack.

TIN IN BELLS SOFTENS TONE

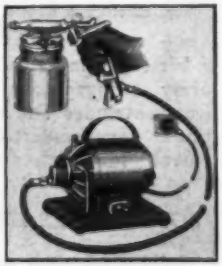
Whistles and bells may be made less disturbing in the noise and din of large cities by using more tin in their manufacture, a British metal expert has found. A fine bronze, containing twenty-five per cent of tin, was found to produce a softer tone less offensive to the ears than sounding apparatus made of brasses or of bronze containing less tin. The tin also gives bells fine ringing notes.

ROTARY GRADER LEVELS LAND FOR FARMING PURPOSES

As a means of reclaiming valuable farming lands in the west that were laid waste years ago by the Colorado river, a rotary grader has been built and placed in operation in the territory. The shovels of the grader move at right angles to the path of the machine, leveling banks and filling in ditches so that the agricultural implement always travels on smooth ground. It has been found valuable in leveling the damaged territory.

ELECTRIC SPRAY SAVES TIME LABOR AND PAINT

Designed for both home and shop work, an electric spraying unit now is on the market that shoots paint, varnish, lacquer, bronze or enamel. The spray gun is attached to an air hose which in turn is fastened to a rotary air compressor. Filling the air gun, attaching the equipment to a light socket and pressing the trigger in the grip handle are the only operations necessary to begin work. It sprays a coat of paint from one to six inches wide and is particularly adapted to refinishing damaged surfaces.



ELECTRICALLY HEATED FACE MASKS FOR PILOTS

Top, Electrically Heated Face Mask and Goggles for Pilot Flying in Zero Weather; Below, Plane on Skis Equipped with Canvas-Covered Heating Element to Keep the Engine Warm

First attempts of the United States army to engage a large air fleet in mock warfare under subarctic weather conditions were undertaken by the "arctic patrol" in which twenty pursuit planes and tri-motored air transports participated in a "fight" over a 3,500-mile battle front extending from Detroit, Mich., to Spokane, Wash. Every modern device for the comfort and safety of the pilots flying in zero temperature was used. Pursuit planes were equipped with skis for landings on ice-coated fields, and a canvas covering about the engine held a chemical heating element to keep the motor warm when inactive. Electrically heated face masks and goggles were worn by the flyers.

SOLID TIRES HAVE BLOWOUTS

Solid truck tires sometimes suffer from blowouts similar to those affecting pneumatic tires. Such blowouts are caused by the collecting of air at a spot where the tire has separated from the steel rim on which it is built. The air bubble, expanding from heat or as a result of the thinning of the rubber by wear, causes the damage.

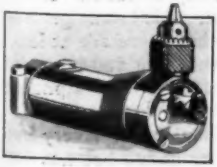
¶Mexican shrimp are being brought to Los Angeles in "refrigerator" planes.

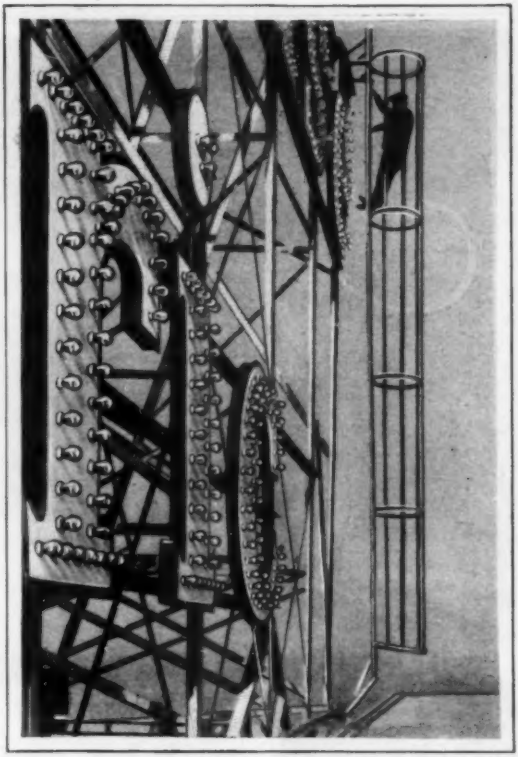
ATLANTIC BLUE RIBBON SOUGHT BY CANADA

The next holder of the blue ribbon of the Atlantic may easily be a Canadian ship, in the opinion of experts, thus introducing a "dark horse" into the race. German, English and Italian builders are agreed that it is not impossible to produce a ship with a service speed of thirty-one to thirty-three knots, which would enable crossing of the Atlantic in four days. Such a ship need not be of more than 30,000 to 35,000 tons' displacement. Experts are not agreed, however, on the type of machinery that would be most economical, although it is implied that none of them greatly favor Diesel drive, since an excessive number of cylinders would be required, and vibration would be a factor. The most practical immediate proposition is the geared turbine, such as is used in the "Bremen." The "Empress of Britain," now being built in England for the Canadian Pacific line and the Canadian entry in the ocean championship, also has this type of drive. Another ship of this line, the "Empress of France," recently accomplished the fastest voyage on record from Hongkong to Liverpool. The distance of 10,000 miles was covered in twenty-two days, steaming 455 miles per day.

OFFSET DRILL ATTACHMENT REACHES ODD PLACES

For drilling in small apertures not easily accessible, an offset drill attachment now is available. It consists of an aluminum body with phosphor-bronze head in which the gears are inclosed, and has a thrust bearing on each shaft. The driving gear is of hardened steel and the driven gear of hardened bronze.





Cage Ladder Which Insures Safety of the Men Who Keep the 1,400 Bulbs in This Electric Sign in Operation

CAGE LADDER FOR SIGN WORKER INSURES SAFETY

As a safety measure, a cage ladder has been installed as part of the equipment for the maintenance of a huge electric sign over the Cleveland foundry of the Westinghouse Electric and Manufacturing company. The cage operates along the 100-foot width of the sign, the electrician in charge of maintaining the 1,400 lamps having ready access to any part of the sign when he crawls inside the cage and manipulates the ladder along its face. The sign itself is unusual in that it is entirely arc-welded, not a bolt or nut being used in fabricating the fourteen tons of steel. Electric welding was employed to enable the sign to withstand the strain of gales from Lake Erie, only a few hundred yards distant. The letters themselves are more than twelve feet high.

If We Had the

Close-Up of Spider Showing the Cactuslike Legs, Many Hairs of Which Are Connected with Scent Glands with Which, It Is Believed, the Spider Follows the Trail of Its Prey

By VINCENT WILCOX

CERTAIN insects, it seems, have as good, if not a better way of communicating than human beings.

People make sounds that have produced a language, while bees and ants do their communicating by their sense of smell. Theirs is a refined method. They have a smell language. If people were able to develop their noses to the extent of these insects, they could listen in on their conversation.

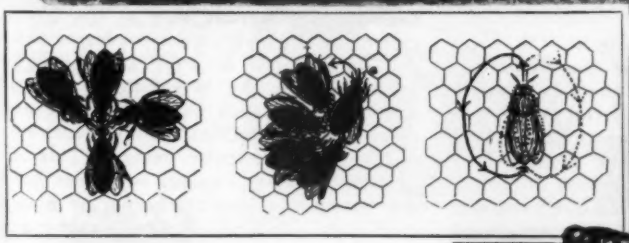
Dr. N. E. McIndoo, of the department of agriculture, determined to discover, if possible, just what means of communication was used by bees. He wondered how bees, for example, know one another, how do they convey information when once they have gained it? How do they know friend from foe?

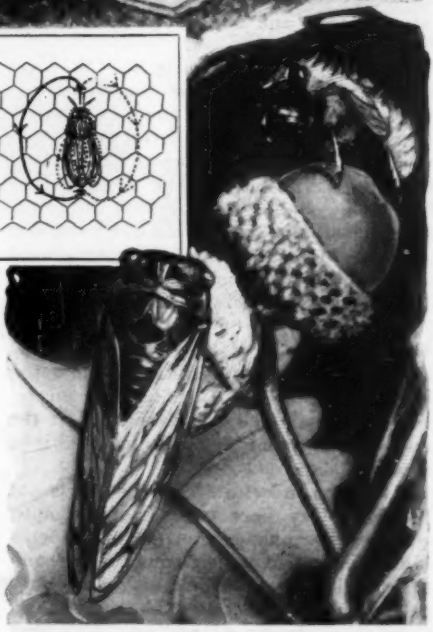
Some have supposed that sight was responsible. Yet it is not reasonable to suppose that each insect in a community of thousands could recognize by sight every other individual in it; hence it was presumed there must be signs or passwords.

Doctor McIndoo has proved that the signs and passwords are largely a development of the smell language. In fact, experiments, tests and long studies showed that many insects have an amazing ability to distinguish odors. They are able not only to quickly recognize a single odor but a combination of several. Theirs is a complicated knowledge. While one odor might stand for one word, they distinguish a number of smells equal to several sentences or even paragraphs, thus receiving a whole group of ideas. In attempting to discover this strange language, it was found that there are at least six different odors that are fundamental and might be compared to an alphabet of the hive.

There is the individual odor. Every bee has its own odor. The queen bee has her specific odor and the workers have theirs. All offspring of one mother queen have a common inherited odor, in addition to the

Sense of Insects

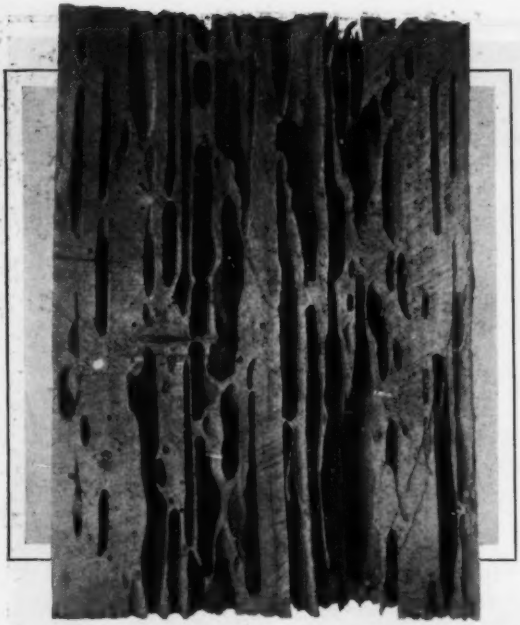




Top, Using Scents and Other Devices in Experimenting with Bees on Government Farms; Below, Figures Formed by "Dancing" Bees When Discovering Food; Right, Harvest Flies Marking Flowers with Their Scent and Gathering the Nectar

individual odors. Then there is the brood, drone, wax, honey and the hive odors.

Carefully developing his own ability to distinguish intricate odors, Doctor McIndoo found that the queen odor seemed to be the predominant one that made for happy bee life. The hive without a queen is not a smooth-running colony. The bees without the pleasant voice of their queen, as expressed in her pervading odor, are irritable and do not work normally. They



Termites Cut These Intricate Labyrinth Passageways in Wood by the Simple Expedient of Following Their Noses

are unhappy and might be called melancholy.

Worker bees, returning to the hives from the field, pass the guards unmolested because they have the proper smell. This shows the ability of the bee to understand many odors, for these workers may be carrying honey or nectar which has its own odor, yet, underneath somewhere is the individual odor of the bee and the hive odor, and it is recognized and gives unchallenged entry.

A bee, however, is in danger of losing its own password or mark. Doctor McIndoo found that if a bee was kept away from its hive for three days, it lost the odor of the colony. Attempting to return, this poor bee was challenged at the entrance. Possibly it was killed or driven away.

But the wonderful sense of smell is not the only way bees talk. For example, when they are happy they dance. Doctor McIndoo watched their round dance and their tail-wagging dance, each the apparent result of pleasure. Von Frisch, a German professor of zoology, says that dancing among bees is almost as common as among people. They express their emotions of joy or happiness. As far as is known, the bees do not dance to music.

Doctor McIndoo watched this strange dancing and noticed that, when a bee returned from scouting for food, it began to dance in happiness. This round dance is a lively little rite. It is a kind of waltz. First, the scout bee salutes its friends of the hive with extended antennæ, while gently crossing and recrossing those of the other bees. While it is performing this kind of "handshaking," it is also sharing its nectar with several of the attending bees.

"The attending bees seem to acquire without difficulty the necessary information about the nectar to be sought," says Doctor McIndoo. "We cannot even guess what the dancer tells the attending bees while stroking their antennæ; neither can we imagine what kind of impression is produced in the 'minds' of the attending bees by the fragrant odor of the flower, carried on the body of the dancer. All we definitely know is that bees become greatly excited by attending the round dance, quickly rush out of the hive and search in all directions for the plants furnishing this particular nectar. This action may help to explain why bees have the habit of collecting nectar or pollen from only one kind of plant on any one trip."

Bees are like people. Their behavior, Doctor McIndoo says, reminds him of people performing a piece of work. "As long as there is an abundance of enthusiasm and work to be done, everything goes well; but as soon as enthusiasm lags and the end of the work is in sight, the organization weakens and quitters become common."

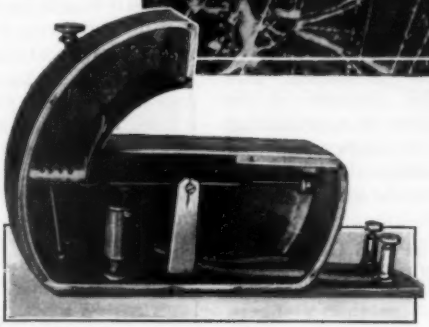
There is a whole language of odors used by bees. For example, Doctor McIndoo noted that sometimes the bees kept their scent organs from being exposed while visiting flowers. And again they would leave this smell-mark on the flower so that after their dance other bees would

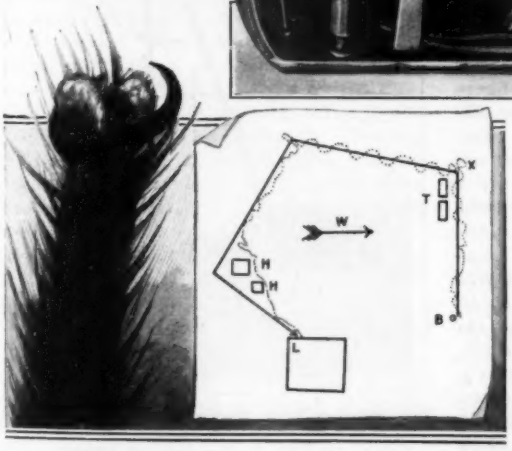
not only find that they had been there, but would note that this flower and its nectar or pollen belonged to that particular hive, since the bees' individual odor and that of the hive were both found. Experiments showed that bees did not poach on flowers first visited by other bees.

Doctor McIndoo's studies proved that not only bees but ants talk to each other through odors. Some ants have a smoky odor, others a pungent and ether odor, and still others smell like lemon, geranium, or oil of citronella, and so on. Ants seem to spread their own colony odor by their feet.

The production of individual odors by insects and animals comes from tiny scent glands that lubricate the skin and hair. Dogs have the ability to distinguish many things by the odor. But even a dog's nose is not as accurate as many insects. During the World War, a lively interest was taken in the breeding of dogs for the rendering of aid to the wounded. At that time an interesting experiment was made on a level, sandy place in Amsterdam where a boy followed a rectangular route ending at a laboratory. The boy walked in the sand and after the trip the dog was started on the scent. Although there were many obstacles and a strong wind was blowing, street cars and people along the way, the dog made the right turns and finally reached the laboratory.

Police dogs succeeded in distinguishing single pebbles held by certain individuals among hundreds, and, what is more, the right pebble would be taken back to the right person.





Top, Fly in Web to Which Experimenters Believe It Was Attracted by Spider's Odor; Center, Device for Counting Bees as They Come and Go; Below, Left, Insect's Leg Containing Scent Glands; Right, Dotted Line Is Route of Police Dog in Tracking Boy from B to L, Arrow Showing Wind Direction

Rear-View Mirror for Baby Carriage, through Which Mother Observes Child's Actions

REAR-VIEW BABY-BUGGY MIRROR KEEPS TAB ON INFANT

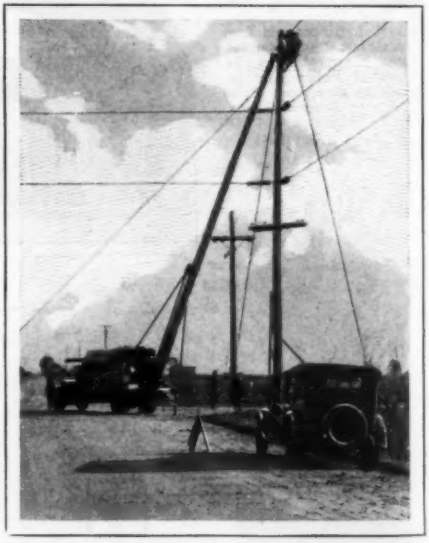
To enable the mother or nurse wheeling the baby carriage to observe what the child is doing, a rear-vision mirror for the perambulator, similar to those used in automobiles, now is on the market. The mirror also allows the operator of the carriage to observe what is approaching from the rear when the buggy is to be turned, just as the driver of a car uses the rear-view mirror for the same purpose.

PISTOL BULLET SPINS COCOON IN SHEEPSKIN COAT

Gunshot experts believe that a sheepskin-lined overcoat may be nearly as efficient a bullet-proof armor as any garment that has been produced for the purpose. One night, early last winter, a railroad detective was making the rounds, wearing a sheep-lined coat, when he engaged in a gun battle with some marauders, who escaped. The detective was shot through the hand and was taken to a hospital. When his clothing was removed, there dropped to the floor, an object that looked like a large cocoon, nearly an inch in diameter. Examination showed that the body of the cocoon was composed of sheep wool. Inside, like a core, was a bullet. The rifling on the inside of the gun barrel causes a discharged bullet to leave the muzzle spinning at a terrific rate. Penetrating the detective's sheep-lined coat, the projectile had twisted the wool around itself until it was about three times its original size and had lost most of its momentum. The experts were not at all surprised at the occurrence. For years, in making test shots, they have fired bullets into cotton batting—a few inches will stop a revolver bullet.

UPRIGHT POLE TIED TO TRUCK BRIDGES POWER LINE

Linemen of a California power company, faced with the task of repairing storm damage to a 110,000-volt power line without shutting off power from a 10,000-volt line below it, solved the problem by lashing a fifty-foot pole to a truck at an angle, the top leaning to the tip of the power-line poles when the truck was in position. This enabled the linemen to climb the leaning pole to repair the high-tension line, without passing through the live 10,000-volt line, which could not be disturbed because poultrymen were hatching thousands of chickens at the time with electrical equipment obtaining power from it.



Pole Lashed to Truck, Enabling Repair of Power Line without Shutting Off Power on Other Lines

WONDERS OF UNSEEN WORLD REVEALED BY LENS

© UFA Kultur

Above, Microscopic View of Seed Pods of Moss Plants; Right, a Tiny Lichen on a Finger Tip; in Circle, a Small Bug in a Microscopic Forest of Lichens

A weird landscape of curious plants and lights justifies the question: Where, would you say, does this forest grow? You would never guess that it is concealed within the world which spreads before your eyes. True, it is so tiny that a vast expanse of it finds room on the tip of your finger. Many a time our feet, walking across country, have stamped out one after another of these minute landscapes. There are growths that might be banks of coral from the bottom of the sea. Others might have served as patterns after which the landscapes of the moon were fashioned. They are so tiny, that a young froglet jumping through the scene, looks like a huge monster jumping over the moon. A bumble bee, coming to drink at a water hole, might be some prehistoric monster. When drouth sets in, all this microscopic vegetation withers like other plants. In the tiny pools, left standing by evaporating moisture, strange monsters may be observed with the microscope. Creatures, looking like miniature Zeppelins, glide slowly and stiffly about. These are known as Infusoria Silica. In ages gone by they have perished in such numbers that their corpses form layers in the earth yards deep. There would seem to be no connection between the dynamiting of huge factory chimneys and these mites, but there is. These dead bodies form the basic component of dynamite.

FLYING WEDGE ADDS TO SPEED OF WILD GEESE

Wild geese, flying through the sky in V-formation, use the wedge shape to increase speed. As the leader forges ahead, he displaces air which is thrown obliquely backward in two diverging surges. Properly spaced behind and to either side the following geese are pushed forward in some degree by these surges which strike their bodies at an oblique angle. Each goose in turn performs this service for the following bird, so that, being led by the strongest bird and graduating backward according to strength, the flock's speed is equalized. The principle is intensified by the wing beats which compact the air immediately behind the wings, so that, as the following bird makes its downward stroke, its leverage is increased as the wings act against the compressed air.

LIONS ARE FILMED IN THEIR NATIVE HAUNTS WITH

Photos Copyright, The

Drawing Illustrating How Cameraman, Concealed in Man-Made Anthill, Took Movie of Unsuspecting Lion with Distant-Release Camera; Left, Viewfinder in Anthill Shows a Lion

MAN-MADE anthills, large enough to conceal three persons, were constructed as places of hiding from which to take moving pictures of wild animal life in the western Sudan by the Court-Treatt expedition which spent a year obtaining the animal photographs for the British film "Stampede." Platforms in trees and hollowed-out bushes also were utilized as "hides" for cameras, but the huge anthills, common to that region, were most successful. A hole, four feet deep, was dug 100 feet from a waterhole, and roofed with poles and grass. The grass roof was covered with mud and carefully modeled to resemble an anthill, after which grass and small bushes were planted while the mud was still wet to make it realistic. Four small windows were provided for the cameras, and, on one side, steps were cut and a bundle of grass pulled over the entrance. The hides did not allow human scent to escape, and wild game appeared entirely unsuspicious. One buffalo cropped grass outside such a camera ambush, and another time, some animals tried to browse off the grass on top, before the mud was set, and broke through. Cameras inside the hides were operated with telephoto lenses, but a distant-release camera often was set at the edge of the waterhole and covered with mud, the release cord being run underground to the anthill. In some instances, even the waterholes were made by hand when no suitable natural watering place was found.

CAMERAS HIDDEN IN MUD ON MAN-MADE ANTHILLS

Illustrated London News

OIL FROM SAND OPENS UP NEW SOURCE OF SUPPLY

Silently, from the four corners of this continent, famous oil authorities slipped into Edmonton during the latter part of last year. They came unheralded and as quietly journeyed out of Edmonton to a small shack some miles outside the city. And in that shack the oil experts who command hundreds of assistants donned overalls and worked as they used to in the early days of their careers. There they witnessed the operation of a centrifuge which extracted pure crude oil from a vast pile of dark-colored sand which had been brought from Alberta. The samples these engineers took home to work on have shown that the oil extracted from the sand can be used as high anti-knock gasoline, when it is refined by the cracking process; that it will make excellent fuel and lubricating oil, can be used as road oil, as paving material, as a pure grade of asphalt for use in shellac, that it approximates a rare product known as gilsonite, and will make first-class roofing asphalt. For many years scientists have looked on the bituminous sands of northern Alberta as the last resource should the world's oil supply in other regions be exhausted. Fortunes have been spent to find ways and means of opening up these bituminous sands to commercial exploitation. Then came an American engineer of world fame, and a Canadian engineer. Between them they concocted an adaptation of the American's device for extracting certain types of ore from other ores. The centrifuge is a machine for separating and cleaning any combination of materials of differing specific gravity. The new method requires only the centrifuge and a supply of warm water. To heat the water in such large quantities as will be required, it is intended to use discarded natural gas wells which are to be found not far from the tar-sand deposits. The natural gas will be piped to the plant to be erected this summer, when a machine with a capacity of 600 tons a day will be placed in operation.

¶Those wishing further information on anything described in the editorial pages can obtain it by addressing Bureau of Information, Popular Mechanics Magazine, Chicago.

Speed Boat Equipped with Wings, Enabling It to Skim along Surface of Water at a Clip of Ninety-Five Miles an Hour

AERO SPEED BOAT WITH WINGS SKIMS SURFACE OF WATER

Designed to skim along the surface of the water at a ninety-five-mile-an-hour clip, a speed boat with wings has been built by a nineteen-year-old Fitchburg, Mass., youth who is considering an attempt to cross the Atlantic in the craft. The aero-marine boat can carry thirty persons and is powered with three motors. The wings are insufficient to lift the boat from the water, but are large enough to hold the craft at an elevation so that it skims the surface, thus decreasing resistance.

SAND SPREADER FOR ICY ROADS PREVENTS ACCIDENTS

Attached as a trailer to a truck, a sand spreader now is on the market which distributes sand or other material on icy pavements much more rapidly and evenly than is possible by hand. The spreader consists of a revolving roll at the bottom of a hopper, which serves as an agitator to carry the material through a steel wire brush, the tension of which regulates the depth. It spreads an even coat of sand, cinders, rock or salt at any speed, the brush allowing the coarser pieces to pass through easily.

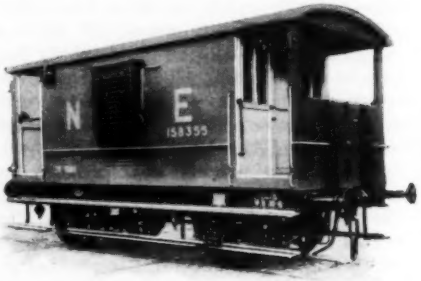
¶More than 1,000 applications for radio patents were filed last year.

WEIGHING PAPER WITH LIGHT

Weighing with light as the medium now is being accomplished with an instrument called the "opacimeter" which uses the light sensitiveness of the photo-electric cell to measure the degree of transparency of a fabric by registering on a gauge, calibrated in weight units, the fluctuations of the current set up in the cell by the varying intensity of the light penetrating the fabric. So far the instrument has been used only in the paper industry. Formerly paper was weighed by clipping a part of the dry product into small sheets of certain size, compressing the sheets into a bundle, and weighing it. This method is not only inaccurate, but troublesome and wasteful. With the opacimeter, it is, of course, the thickness of the paper that governs the operation of the photo-electric cell, but the apparatus is wholly automatic.

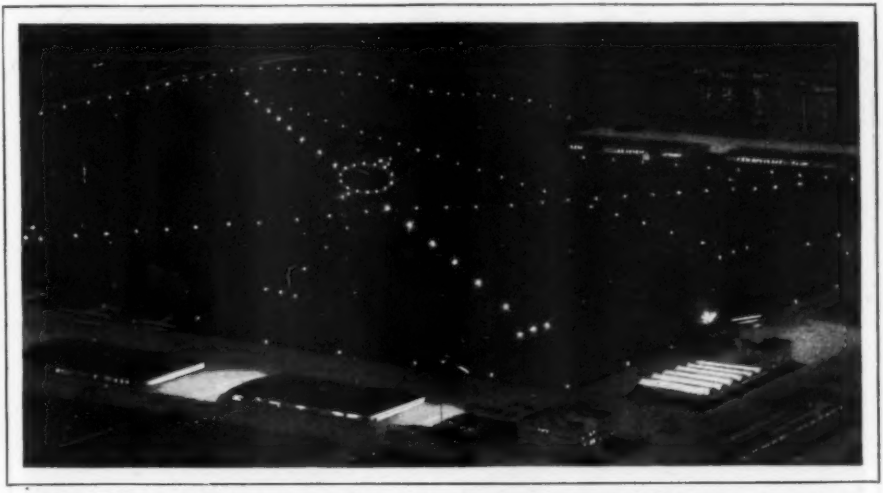
CONCRETE RAILWAY CAR MADE ON STEEL FRAME

Built on a reinforced-steel framework, a concrete railway car is being tested in England. The sides, floor and roof are of concrete, the car being placed on a standard steel undercarriage. If the car proves serviceable, as expected, many of similar design are to be built.



Railway Car of Concrete, Built on a Steel Framework, Which Is Being Tested in England

ROBOT THAT NEVER SLEEPS GUIDES LANDINGS



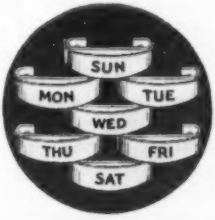
Landing-Field Lights and Wind Arrow Which Are Illuminated Automatically to Indicate the Runways and Show the Direction of the Wind for the Guidance of Pilots at Night

Greater safety in night airplane landings is the object of an automatic system of field lights which indicate the direction of the wind and the proper runway for the descent. A dotted line of lamps, set flat in the ground where they offer no obstruction, shine without glare and are lighted without the aid of human attendants. One of the most successful installations of the systems is at the Grosse Ile airport, at Detroit. Each of the three runways has a row of lights, each line being flanked at either end by two lights to form a "T." On the roof of a control house near by, a vane points in the direction of the wind and, by its position, causes a corresponding row of lamps to burn. This is done automatically by contacts made through a special control board as the arrow moves. The lamps are strongly constructed so that heavy ships will not shatter them.

PAINTS STICK BEST TO WOOD GROWN IN SPRING

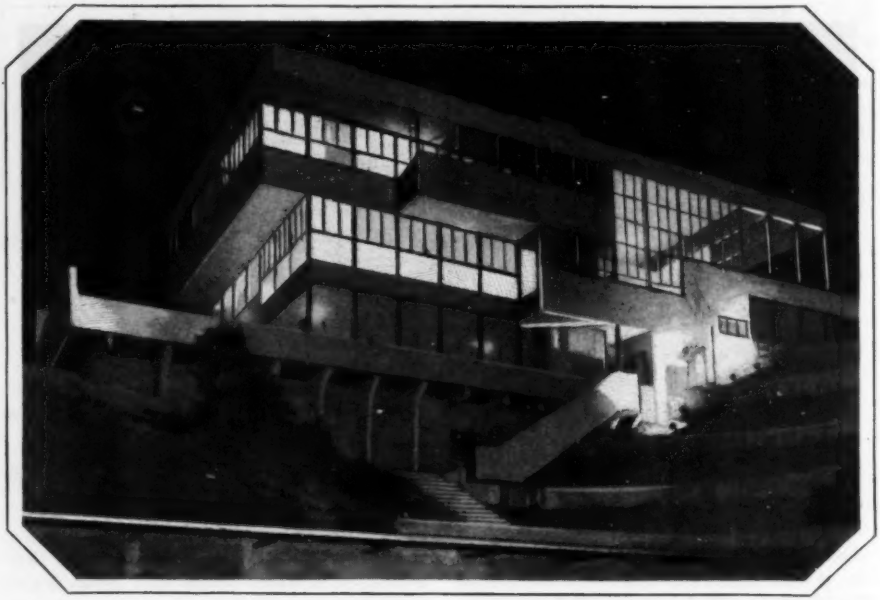
Scientific experiments have shown that the part of wood grown in the spring retains paint better than the summer wood. The summer growth is dense, horny and darker-colored than the spring. Lightweight wood of even texture has thin bands of summer wood and holds paint well, but most heavy woods are uneven with wide bands of summer wood and hence shed the paint. Edge-grain boards expose summer wood in narrower bands and hence hold coatings better than flat-grain cuts from the same log. Aluminum paint as a primer under customary house paints on summer woods has been found to lengthen the life of the coating.

METAL BAND FOR MILK BOTTLE SHOWS AGE OF CONTENTS



To enable the busy housewife to determine, without tasting or guessing, the age of milk contained in partly filled bottles, a set of metal bands for the neck of the bottles now is available. Each band is stamped with a day of the week, and as the milk is received, the proper band is snapped around the bottle neck. A round metal holder is provided to store the markers when not in use.

HOME OF CONCRETE AND GLASS BUILT FOR HEALTH



Home of Concrete, Steel and Glass Designed Entirely from Health and Comfort Standpoints; Note the Provision for Sunlight and the Several Open-Air Sleeping Porches Provided

Steel, concrete and huge areas of plate glass have been used in building a modern Hollywood home, architecturally designed from a health standpoint. The house has been made modern in every way to conform to the best standards of good living, but with ample provision for sunlight, open-air sleeping quarters, efficient heating and ventilating systems, labor-saving conveniences, sanitation and adequate recreation facilities. Radio and phonograph outlets are provided on every floor, and all illumination is from indirect lighting. Tennis and handball courts and a swimming pool are among the recreations included. The house is constructed on a central frame with balconies and even parts of rooms are supported on cantilevers. The concrete was applied by the gun method to obtain rigid, long-lasting walls. The structure is fireproof and resistant to earthquakes. Bathrooms have vitreous-paneled walls with all fixtures wall-hung, and the kitchen is provided with such conveniences as water filter, electric dish washer, fruit-juice press and a hopper to the incinerator. The cost of steel construction was found to be only about five per cent more than wood.

SMALLER AUTO TIRE IS SAFER BUT WEARS OUT SOONER

Smaller automobile tires are being used on many 1930 cars, the cross-sectional diameter being greater while the circumference of the wheel is decreased. This provides a lower center of gravity with resulting greater safety and more pulling power, but there is an increase in the rate of tire wear because the wheels must make more revolutions to the mile, and tests have shown that the rate increases in more than direct proportion to the decrease in tire circumference. Experiments indicate that a tire with nine per cent less circumference shows a decrease of twenty-two per cent in mileage as compared with the larger one. This year a different system of marking is being adopted, the tire's cross-sectional diameter being followed by the diameter of the rim it fits.

STEAM FROM VOLCANO TO HEAT HAWAII HOTEL

Natural steam heat from Kilauea volcano is planned for a hotel on the island of Hawaii as a result of experiments by a scientist who used the volcano's steam for several years to heat his laboratory. The hotel will utilize the natural low-pressure steam issuing constantly from fissures in the earth. Steam vents will be tapped by holes drilled into the rock and the steam will flow into a boiler, heating water in its pipes. The steam itself cannot be used in pipes, as it contains corrosive acids. The heat supply is considered dependable, as rain falls regularly and seeps down to the hot rocks. Although the island is in the tropics, the volcano is high enough to be in cool weather the year round. Kilauea is unique in that people run toward it instead of away from it when it is in eruption, finding safety on the edge of the crater. Volcanic steam is used for heat also in Japan, New Zealand and Iceland, and generates electric power in California and Italy.

Metal Net about Australian Bathing Beach to Protect Swimmers from Man-Eating Sharks

METAL NETS PROTECT BATHERS FROM MAN-EATING SHARKS

Swimmers in the ocean near Sydney, Australia, are protected from the man-eating sharks by a strong metal net which keeps the tigers of the sea outside the confines of the bathing beach. The nets, made of wire, are stretched about the place, and weighted at the bottom to hold them down.

SAFETY THUMB GUARD FOR BABY CORRECTS BAD HABIT

To correct a baby's tendency to suck its thumb, a safety wire guard now is on the market. The diagonal wires break the suction, and the wire itself is in one piece with looped ends to guard against injury. It is tied on with tape and does not hinder the use of the thumb while in place.

¶Para rubber trees planted in Florida are making remarkable progress, according to government scientists.

HIDDEN LOCK FOR TIRE MIRROR ELIMINATES CHAINS

Eliminating chains and padlocks to secure the rear-view tire or fender mirror, this accessory is now provided with a concealed locking device. In the base is a ratchet which winds up the locking band, and it cannot be unwound without inserting the key. The mirror may be turned at any angle.

New CONVENIENCES

Ice Cubes Are Easily Removed from This Container; It Is Made of Tough, Flexible Rubber and Can Be Bent

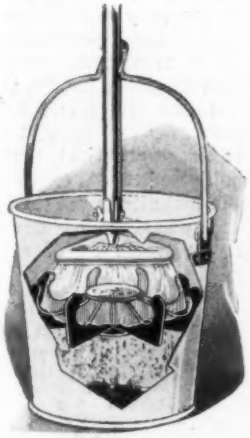
This Sturdy Stool for Many Household Tasks Has a Step That Folds into the Base and Also Serves as a Footrest; the Unit Is Constructed of Steel and Will Support Over Half a Ton

Raised Edges on This Flatiron Rest, Which Fits Any Board, Prevent the Iron from Slipping Off, and the Support Permits Sliding the Iron On Instead of Lifting It

Something New in Clothespins; It Has a Wire Belt That Makes the Pin Much Stronger, Eliminating Splitting; the Slot Is Smooth and Free from Splinters

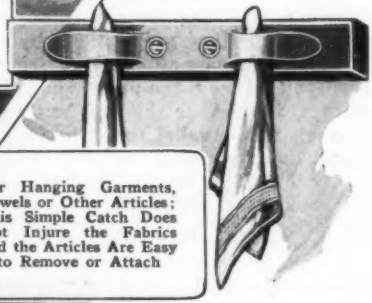
Here Is an Adjustable Shoe Rack That Extends to Thirty-Five Inches; It Screws into the Wall and May Be Used Also for Neckties or Towels

for YOUR HOME

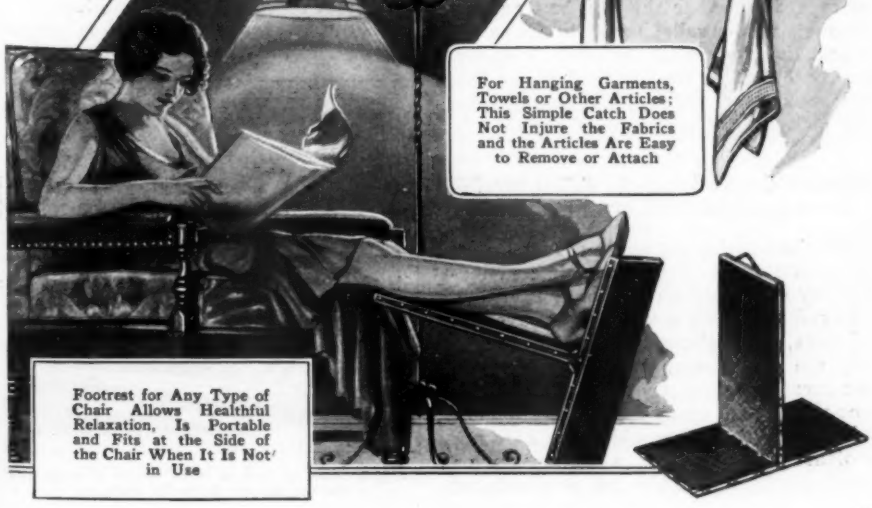


Scraper Blades inside Bucket Clean the Dusting Mop in Little Time; They May Be Used on Dry or Oiled Mops; the Pail Is Emptied by Removing the Blades

Ironer Attachment Fits on the Wringer Shaft at the Proper Height and Saves Lifting and Extra Adjustments; It May Be Left On at All Times and Swings Out of the Way



For Hanging Garments, Towels or Other Articles; This Simple Catch Does Not Injure the Fabrics and the Articles Are Easy to Remove or Attach



Footrest for Any Type of Chair Allows Healthful Relaxation, Is Portable and Fits at the Side of the Chair When It Is Not in Use

Mail Plane with Hook Attachment, Snatching Mail from Truck by Hooking Line between Upright Posts to Which Bag Is Fastened

PLANE IN FLIGHT PICKS MAIL FROM TRUCK ON GROUND

Air-mail planes now are enabled to snatch a mail bag from a truck on the ground while they are in flight, by means of a hook and wire attachment. The hook is suspended from the plane, and the wire or rope, attached to the mail bag, extends through two parallel uprights above the truck, thereby giving the pilot an opportunity to pick up the bag by flying so that the hook passes between the poles. After the pick-up, the bag is pulled aboard.

TRAFFIC JARS DO LITTLE HARM BUILDING TESTS SHOW

Needless alarm has arisen in many cities as to the effect of traffic, train and machinery vibrations on buildings, according to Prof. C. C. Williams, of the University of Iowa, who believes that such jars usually are exaggerated by the senses. To the average person, a vibration of but one one-thousandth of an inch at a frequency of ten per second would seem a rather violent shaking. The vibrations from most earthquakes have an amplitude of but a fraction of an inch, Professor Williams declares. Tests have shown that truck, train and machine vibrations do not materially weaken the bearing capacity of piers or masonry walls. Where buildings, particularly brick structures up to four stories in height, are founded on plastic soil, they may be expected to settle somewhat when subjected to vibrations of the magnitude caused by the passing of heavy street traffic or of railroad trains.

NET IN TOP OF CAR CONVENIENT FOR TOURING

Packages which ordinarily are tossed on the seat or floor of the automobile, now may be stored away in a convenient net which attaches to hooks in the top of the car. The net keeps all packages in plain sight and easily accessible by unfastening the hook nearest the package wanted, but at the same time entirely out of the way. The carrier fits any make of car and is adjustable by changing the position of the loops fitting over the hooks, thus keeping packages in their original position.

Carrying Nets in Top of Auto Which Provide Convenient Storage Space for Packages

A Drug Store from the Sea

Kelp-Cutting Barge, Which Is Towed about the Kelp Fields, Harvesting a Wide Swath on the Surface of the Sea; It Differs from the Self-Propelled Barge Shown in Another Photo

Wonder Gardens Beneath the Waves Equal or Surpass Those to Be Found on Land

By H. H. DUNN

IF THE earth is the mother of all of us and the air our nurse, as the ancient philosophers believed, then the salt waters which cover three-quarters of the surface of the globe are the chemical laboratory of the world. From the present supply of chemicals—animal, vegetable and mineral—held in the seven seas and their salty sisters, enough can be drawn to supply many of man's needs for the next thousand years or more—nearly 100 different, and widely varying drugs, from which approximately 1,000 medicinal products may be made.

The greatest sources of some of our best-known and most useful drugs are in the ocean, held in suspension in their waters, carried hither and yon by their finned wanderers, or borne in the trunks, branches and leaves of their vast plant life, estimated to equal, if not exceed, all the plant growth of the land. Undoubtedly, there are still other chemicals, probably many of them, whose largest and most valuable sources are the seas, but for which practical commercial methods of separation have not been devised. Some of the world's salt, for example, is taken from the sea; by far the greater part of it is mined and leached from deposits in the earth; yet if all the salt could be taken from the ocean, there would be 4,500,000 cubic miles of it, so great a quantity that all the known salt deposits of the earth could be buried in one small corner of it!

Gold is the least valuable mineral taken from the sea; indeed, it is the least of the products of the sea, though man has put millions of dollars into various futile schemes for extracting the yellow metal

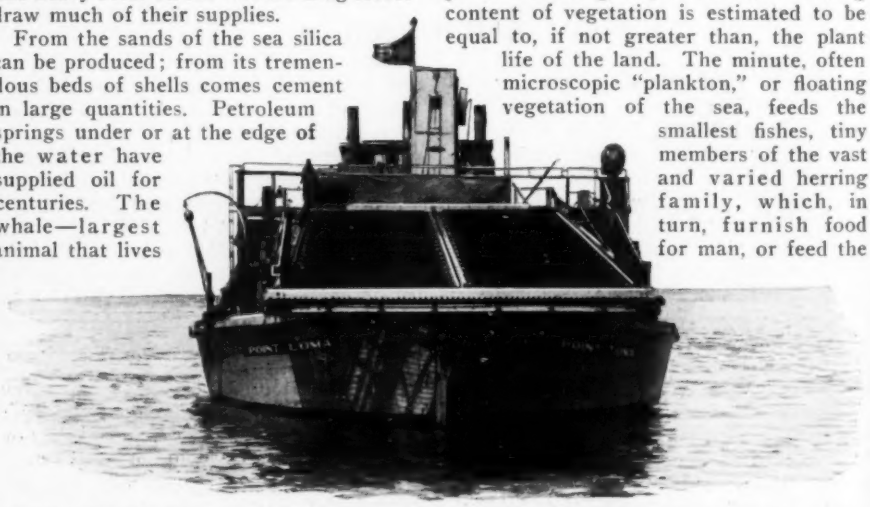
from sea water. Silver and radium also occur in the salt waters of almost all parts of the globe, but no profitable method of extraction has been found. Yet with every 100,000 tons of salt that is taken from the world's oceans, come 2,800 tons of chemicals with a value in excess of $200,000 at wholesale prices.

The common bath salt, colored and perfumed until even Mother Nature would not know it, comes from several sea-salt evaporation plants. Glauber's and Epsom salts are produced from similar sources. Bromine, chlorine, potassium, sodium, magnesium, iron, strontium, barium, an arsenate or two, and silica sand, are other profitable by-products of the making of salt from sea water. Modern methods of sea-salt production depend on the taking of the salt from the water after some of the other salts have been precipitated, and before others appear as solids. This is a nice scientific and mechanical process, though the equipment used is merely clay-bottomed ponds alongside the bay or ocean. After the salt has been taken out, washed and sent on its way to the refinery, the mother liquor ("bittern") remains. This is saturated with the other chemicals which have been brought by the earth's rivers and brooks to the seas for countless centuries, and from this heavy solution the world's drug stores draw much of their supplies.

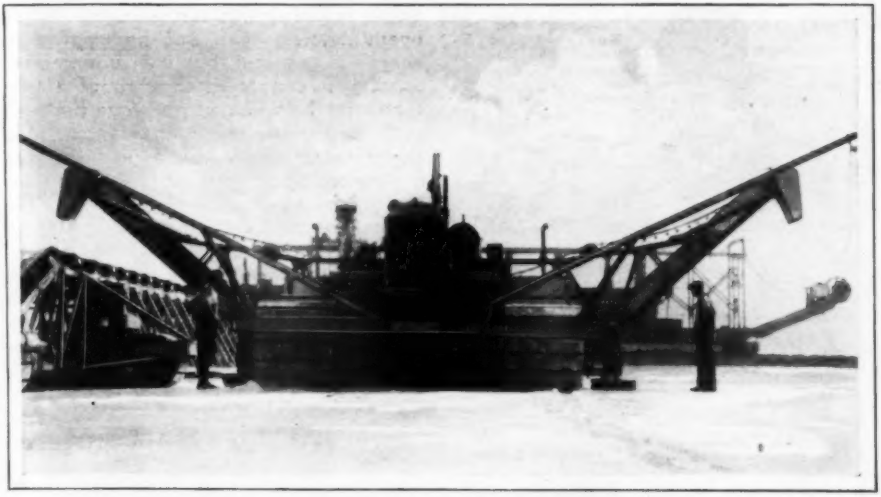
From the sands of the sea silica can be produced; from its tremendous beds of shells comes cement in large quantities. Petroleum springs under or at the edge of the water have supplied oil for centuries. The whale—largest animal that lives on this globe—gives milady ambergris, the basis for her finest perfumes, and at the same time valuable animal oils. In the past, it yielded the stays in which the woman of fashion bound herself, while today this mammal furnishes with its flesh and bone one of the most powerful of fertilizers. In the not distant future, it is probable that adrenalin in considerable quantities, and thyroid extract in greater amount, will be taken from the glands of whales.

Oil from several varieties of fish is on the shelves of every drug store, and men are finding practical uses for the skins of whales, sharks, dolphins, the larger rays and some other fishes. Pearls are being made from fish scales, and the teeth of whales and the larger sharks make a useful substitute for elephant ivory. Approximately 127,000 men were paid $113,000,000 for 3,000,000,000 pounds of fish they caught in the waters of the United States in 1928, during which year the consumption of frozen and canned fish in this country increased 350 per cent over that of 1926.

But it is from the plant life of the world's oceans that the drug stores draw their largest supplies of chemicals. To most persons, the seas are barren wastes, yet these salt waters cover the most extensive forests, containing the tallest plants on the globe, while their floating content of vegetation is estimated to be equal to, if not greater than, the plant life of the land. The minute, often microscopic "plankton," or floating vegetation of the sea, feeds the smallest fishes, tiny members of the vast and varied herring family, which, in turn, furnish food for man, or feed the



Self-Propelled Kelp Harvester Used on the California Coast; the Huge Machine Is Shown with Cutter and Elevator Drawn Up as the Vessel Is on Its Way to the Kelp Fields



Tractor with Rotary Digger Used on Salt Farm; the Salt Is Elevated to Conveyors and Carried to a Barge, Another Tractor Towing the Barge by Canal to the Cleaning Plant

larger fishes, on which man feeds. From this ever-moving plankton, plaything of tides and currents, the vegetation of the seas passes upward to giant weeds, fixed on the rocks of the sea bottom, their leatherlike trunks stretching 400 to 500 feet up to the surface.

On the way up this vegetational scale, we pass a hundred or more sea grasses, growing out to such depths that men in diving suits cut these submarine lawns, while mechanical harvesters strip the surface of the sea—both to provide supplies for the drug stores of the shore. For centuries man, primitive and civilized, has eaten seaweed as a food. Somewhere along the way he found that some of these weeds helped him in his fight on certain diseases—the iodine content of the so-called kelp reducing goiter; Irish moss helping bronchial and lung disorders; others keeping the stomach in better condition—to name a few of the simpler and better aids to man among the gardens of the sea. But when scientific investigation and mechanical methods of production were brought together on the seaweed beds, man began to get potash, iodine, bromic acid, ammonia and more than a score of other chemical products. The queerest of these—agar-agar, the "cold-cold" of the Malay seaweed eater—leaped into demand overnight as a culture medium for bacteria.

Large plants for the production of chemicals from the kelp beds and from the smaller seaweeds have been erected in the United States, notably in California, and similar establishments have been or are being set up in France, Italy and Scotland. Men had been working for some years on methods for the extraction of chemicals from kelp, but it was not until the World War presented a great demand for potash, that it was found that the kelp beds of the Pacific coast of the United States are of sufficient extent to yield more than 60,000 tons of the weed every year, and that this kelp has a larger potash content than any other. Figuring two cuttings a year, these kelp beds, ranging from about the central point of the coast of western Alaska on the north to Cedros island on the south, are estimated to yield more than 2,500,000 tons of potassium chloride annually.

This kelp is harvested by what amounts in principle and practice to a very large hay-mowing machine, mounted so that it cuts the kelp from four to six feet below the surface. As it is cut, the seaweed is passed up an incline on endless chains to the deck of the barge at the bow of which the cutter is attached.

Pneumatic Road Drill Equipped with Silencers Which Deaden Much of the Noise of This Tool

"SILENT" ROAD DRILLS REDUCE CONSTRUCTION NOISE

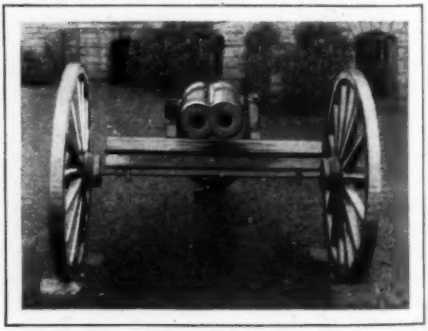
Equipped with a silencer which eliminates more than half the noise and much of the vibration, a pneumatic road drill attracted much attention when exhibited recently in London. It was made for the use of contractors who meet with protests against the noise made by the ordinary drill exhaust. The silencers, clustered around the center of the drill, are designed along the principles of the motorcycle silencer.

TRUCK REFRIGERATES ITS LOAD WHILE IT TRAVELS

Keeping its contents cool as it travels, a truck recently has been placed in service that serves the same purpose in transporting perishables by road as the refrigerating car does by railroad. Tests have shown that temperature in the van may be maintained constantly under forty degrees with an outside reading of 100 or higher. The system is operated from the driveshaft of the truck and may be engaged or disengaged by the driver. When operating, less than one horsepower of energy is required, but it is unnecessary to keep it connected throughout a trip, the driver being able to observe the temperature inside the van by glancing at a thermometer behind him. Refrigeration is obtained by passing air through a radiator by means of a fan operated from the truck shaft, and cooling methyl chloride, which, in gas form, is forced into a compressor, then through the rear outlet and into the coils of the van. By making a few changes and bringing hot water from the radiator of the truck motor, the refrigerating unit may be turned into a heating system for the van in winter.

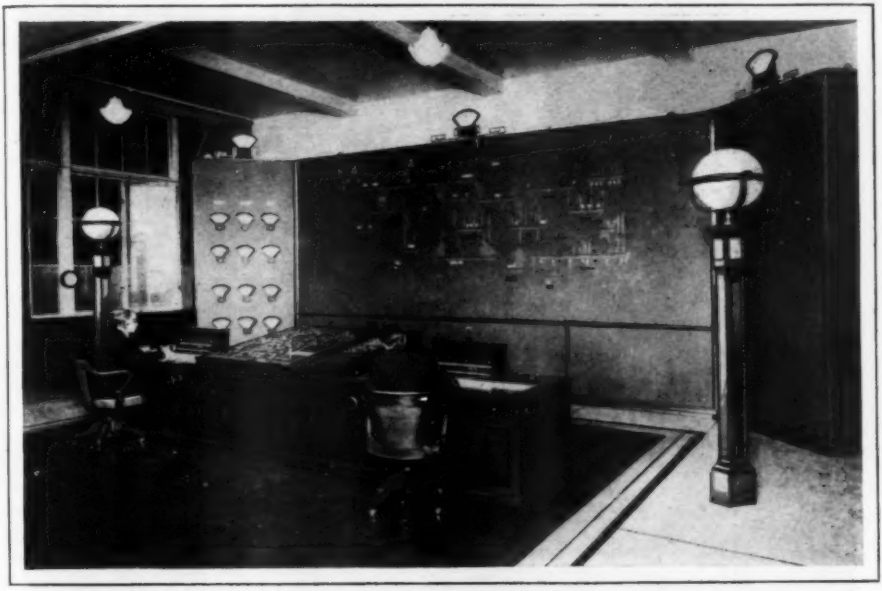
WHY DOUBLE-BARRELED GUN FAILED TO WORK

On the public square at Athens, Ga., stands the only double-barreled cannon in existence, a weapon built by an inventor of Confederate sympathies during the Civil War. The inventor made the weapon with the idea of connecting two cannon balls with a long chain and firing them simultaneously. The balls, it was reasoned, would travel in parallel courses and mow down everything in front of them with the connecting chain, inflicting wholesale slaughter. The scheme came to grief when it was found that it was impossible to fire both balls at the same rate of speed. The one going the faster simply dragged the other behind by the chain and the weapon proved no more destructive than the single-barreled kind then in use; so only the one was built.



Double-Barreled Cannon Which Was Intended to Fire Two Balls Connected by a Chain

CITY'S ELECTRIC BRAIN IN POWER-CONTROL ROOM



General Control Room of the London Power Company—the Brain of London's Electric Supply System; on the Walls Are Maps Showing the Type and Amount of Power Going to Various Sections

What may properly be termed the brain of London's electrical supply is contained in the recently constructed general control room of the London Power company. Besides housing the apparatus controlling the supply of power to all parts of the British metropolis, the room is equipped with maps of various parts of the city, indicating the type and amount of power going to these sections.

HUMAN HAIR MAKES CHEMICAL IMPORTANT IN DIET

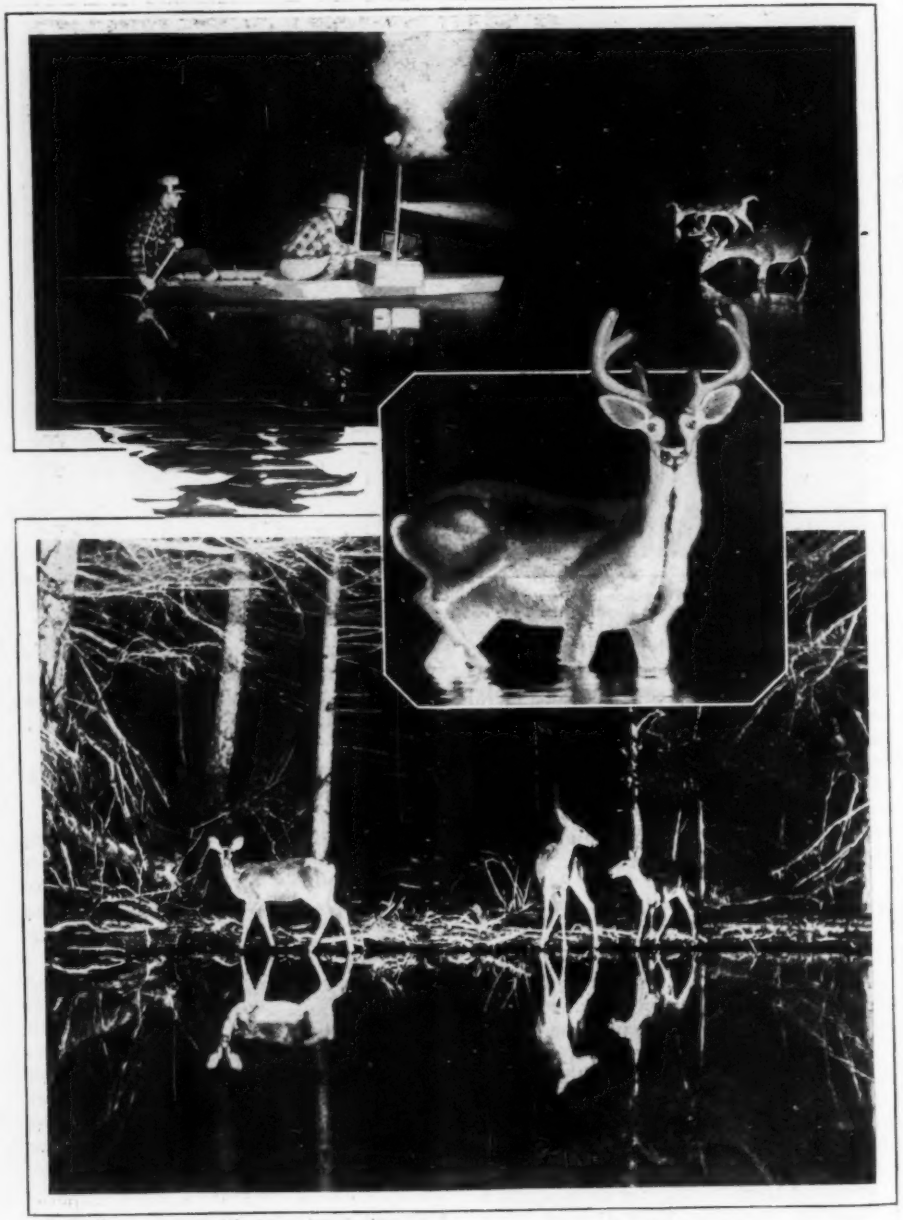
Hair clipped by barbers from the heads of University of Pennsylvania students has been put to a useful purpose in the chemistry laboratory where eighty pounds of it is cleaned and treated monthly, being used as the basis for the manufacture of cystine, an expensive chemical employed in research work. Cystine is an important constituent of the protein diet. The hair as it comes from the barber shop is freed of foreign particles, then treated with hydrochloric acid in which it is digested, whereupon the acid is neutralized and the cystine precipitate emerges in beautiful white six-sided crystals. During a year more than $800 worth of the chemical was made by this method.

FINGER MOISTENER FITS HAND LIKE A WRIST WATCH

Fitting the palm of the hand as snugly as a wrist watch might, a finger moistener now is available for the convenience of those handling paper or money. It consists of a metal band with a felt pad and water reservoir which leaves the fingers free to write or post and saves reaching for a sponge to moisten the fingers.

¶Shoes, the soles of which are made from cast-off automobile tires, are being sold abroad.

HOW THE CAMERA MAN GOT HIS MASTERPIECES



Triumphs in Photography; Hobart V. Roberts, of the New York State College of Forestry, Took These Night Snapshots of Deer by Using a Canoe and Special Lights as Shown in the Photograph at the Top

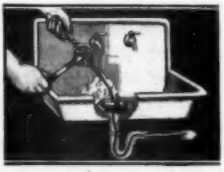
ART OF CERAMICS LATEST AID TO SEARCH FOR OIL

Based on the theory that no two clays will burn the same color in the same temperature, a method has been developed for using ceramics to help scientists in their search for oil. This is the latest of some fourteen recognized scientific means now employed to discover oil fields, and is being used when other methods have failed. Soil likely to give a clue as to the presence of oil may be identified by its color after burning, scientists have discovered, and at the same time they make other chemical tests to determine the nature of the sample. According to Dr. Charles Gould, of Norman, Okla., a recent survey of 170 oil fields showed that thirteen of them had been brought in by accident and 157 by geologists using intelligent methods. In late years, 815 wildcat wells have been drilled in California, but none produced oil.

Ground Station in England from Which Instructions Are Sent by Radio to Student Pilots Making Their First Flights Unattended

STOPPED-UP PIPES CLEANED BY SHAFT ON DRILL

Opening up a crooked stopped drain or sewer pipe is simplified with a flexible pipe cleaner which is driven by a breast drill. The apparatus consists of the flexible shaft, on the end of which is a cleaning tip for removing scale and rust. When rotated by the drill, the snakelike shaft advances automatically through a feeding block clamped into place at the outlet opening. The cleaner may be obtained in various sizes and lengths.



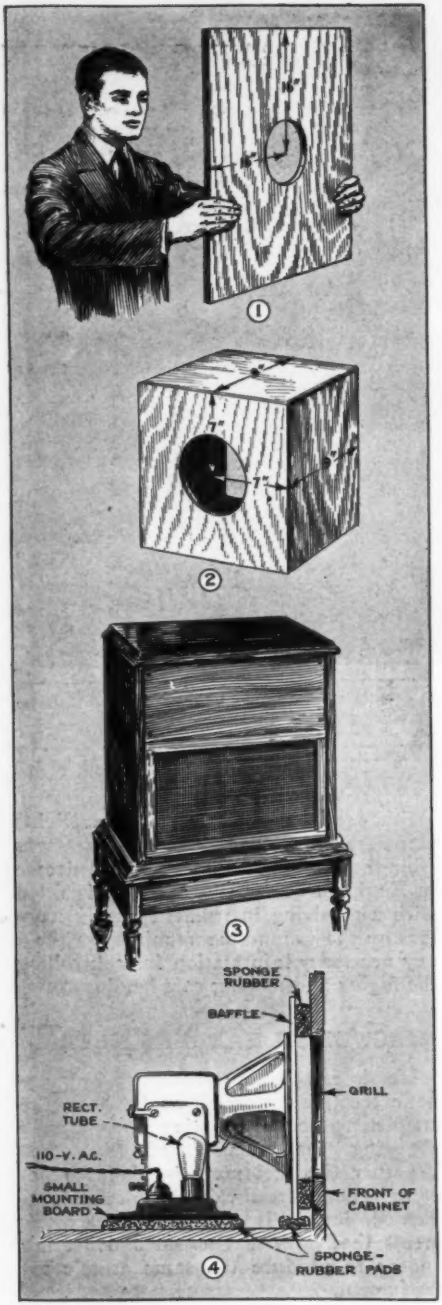
WIRELESS AIDS STUDENT PILOT IN FIRST SOLO FLIGHT

Student flyers making their first flights alone are being aided by wireless messages from the ground at the Heston aerodrome in England. The student's ship is fitted with a receiving instrument and instructors on the ground communicate to them any necessary information for controlling the flights and making safe landings.

MAGNETISM HARDENS METALS

Metals can be super-hardened by magnetic treatment as well as by heat, the magnetic process consisting in repeatedly changing the polarity of the steel. Whether this treatment is likely to become of commercial value has not been indicated, but it is evident from experiments that both magnetism and heating appear to produce the same atomic arrangement.

Improving Tone



TO REALIZE the utmost in tone from your dynamic speaker, experts declare that the nearest edge of the baffle should be at least 16 in. from the center of the cone opening, as shown in Fig. 1. With this distance the speaker will reproduce faithfully down to sixty vibrations a second, below which few ears can hear. For greater accuracy, the distance should be made 32 in., which will bring the tone down to the bottom notes of a piano.

When the speaker is mounted in a console, however, the entire cabinet, top, bottom, front and sides, acts as a baffle, and the distance is then figured from the center of the opening to the nearest back edge of the cabinet, as shown in Fig. 2. The back should be open and covered with a large-mesh screen, Fig. 3, or have several fair-sized holes in it, to prevent damping effects on the back of the cone, due to imprisoned air.

The baffle material may be anything that is firm and has a hard surface. Wood is satisfactory, but it should be 1 in. thick so that it will not vibrate excessively. If the baffle is placed in a console, it should be insulated from the cabinet with sponge rubber or felt pads as illustrated in Fig. 4. The pad under the speaker base is not essential, but helps in some cabinets of light construction.

A short horn, added to some dynamics, may improve the reproduction, but is not recommended in most cases, as it has a tendency to cause resonances. Nor, is it practical to use a dynamic with small battery sets, as the cost is prohibitive, or with a high impedance-output tube, such as the UX-201A, because the low tones will be cut off. A magnetic speaker should be used in all such cases. A dynamic speaker gives poor reproduction when worked far below its normal output.

Aside from proper installation, the dynamic itself needs no adjustment. Experience goes to show it is virtually indestructible. In test to see how long a paper cone would last, a laboratory set a dynamic in a loft room and let it run six months day and night on one note. A cone, only 7 in. in diameter, was used, and the note was a low one of sixty vibrations

# of Your Dynamic

a second in order to give the cone a long jerk of ¼ in. on each vibration. The test started April 1, 1929. At the end of September it was discontinued, the cone having run without interruption all that time; it was singing just as loud and clear as at the start, and showed no signs of breakdown.

Sound coming directly from the loud speaker of a set intermingles with that reflected from various surfaces in a room. If there are too many hard surfaces, too much reflection will occur, and the radio will sound unnatural. If you ever have heard a set operating in a room devoid of all furnishings except the radio receiver, you will appreciate this condition. On the other hand, too many soft objects, rugs, draperies, upholstered furniture, and the like, will cause too much sound to be absorbed, and the music will have a "dead" tone. It is because of such absorption and reflection that a set often sounds differently in a store and in the home. Fortunately, the average home has its furniture and other contents so arranged that a happy medium exists, and there is nothing to worry about as far as too much or too little reflection of radio or phonograph music is concerned.

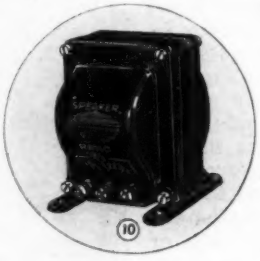
Prof. John Martin, of the Case School of Applied Science, maintains that any good amplifying system can be built to perform as well as another. This does not mean that a set of cheap transformers will turn out as excellent quality as a set which has received careful engineering attention, although the performance of poor transformers can often be improved by shunting resistances or condensers across the primary and secondary windings. A good resistance-coupled amplifier has been found to give excellent all-around results. Its main drawbacks are the low gain per stage and the relatively high voltage required, but with modern equipment these are easily surmounted. Such an amplifier is remarkably free from distortion, because only the tubes do the voltage boosting. By changing resistances and coupling condensers, such an amplifier can be made to cover any tone range and to emphasize certain portions

of the musical scale. Large coupling condensers improve low-note rendering and small ones emphasize the higher tones.

Impedance coupling is so similar to resistance that there is not a great deal of choice between them, except, perhaps, the cost of the coupling units. Inefficient transformers can be "doctored" like resistance or other circuits, so that the quality can be regulated to a considerable extent.

According to one authority, there is no need to use two 250-type tubes in order to get good reproduction in any set intended for the home. One 250-tube, if conditions are correct, is more than enough, and, with proper design in the set, two 245-tubes in push-pull are all that is necessary. In fact, the 245-tubes are preferable both from the standpoint of economy and with regard to weight of the complete set.

A radio tube, to operate as a good amplifier, must have its grid potential kept negative. If it goes positive, distortion will result. That is why C-batteries or a negative grid bias are used. So, if your radio develops the tendency to leave out the hissing tones of the voice, or otherwise distorts issuing sound, you should investigate the negative grid voltages.



There is a simple device that you can construct and use for modifying the quality of your speaker, regardless of type. It is connected across the secondary of the second a.f. stage, and is merely a series of condensers of various sizes, arranged so that they can be shunted across one at a time, as shown at A, Fig. 6. The individual units may be of capacities ranging from .00005 to .001 mfd., or up to .01 mfd., and are arranged so that a rotary switch, like those common on the first radio receivers, connects one at a time into the circuit. When the capacity which seems to give the most satisfactory results has been selected, a simple permanent tone control may be provided as shown at B. This consists of the selected capacity, X, in series with a variable 100,000-ohm to ½-meg. resistor connected across the secondary of the second a.f. transformer. The tone can then be adjusted to suit the most critical ear. Some speakers have an output filter built into the speaker unit and some of the older ones have a condenser across the primary of the output transformer. In some cases, these condenser values may be greatly reduced or removed with a corresponding increase in high-note rendering.

Perhaps you can improve the quality of your speaker by changing its location in a room. Large portable loud speakers, of the types shown in Figs. 5 and 7, are best placed in a corner or against a large wall surface which will act as a baffle. This is especially true of cones. The radio set with built-in speaker likewise performs best in a corner, as in Fig. 8, and should not be directly against a flat wall. Whenever possible, the speaker should be at ear level; if you build your speaker into a small cabinet of the type shown in Fig. 9, therefore, it should be placed on a table or mantel for best results. And remember that the weather often affects speakers, especially cones that absorb moisture; so don't condemn your set too hastily. It may be suffering from a temporary speech affliction.

The home builder is often told that the impedance of his output tube should match the impedance of his speaker. This, of course, is so much Greek to the uninitiated. The engineer can, and does, when designing a manufactured set, match these impedances, but the amateur cannot match the impedance of a speaker, which he does not know, with the impedance of a tube, which he also may not know. With this in mind, manufacturers are making output transformers with tapped secondaries, as shown in Fig. 10, which make the approximate matching of the impedances a mere matter of trying one or the other of three taps. On such transformers, the leads to the speaker are tried first on one set of taps and then on the other until the best combination is found.

The transformer built into the average dynamic is matched for average power-tube outputs, and gives good results on any homemade set. If the builder wants to experiment, however, he can cut out

the transformer in the speaker and use one of the new output transformers in his set. To do this, he must find the leads from the secondary of the speaker transformer that go to the voice coil, and clip them, as indicated in Fig. 12. New leads are then taken from the voice coil to the tapped secondary of the new output transformer, which may be made a part of the set assembly, or mounted on the speaker in place of the old transformer. As mentioned above, the combination of taps on the transformer giving the best results is the one used. No other changes are necessary in the speaker. Most large cabinet dynamic speakers of the type illustrated in Fig. 5 have sufficient space below the speaker shelf for the installation of a separate power amplifier, as shown in Fig. 11. This is an excellent idea in cases

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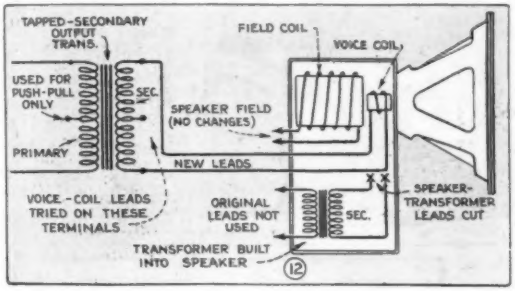


where the audio installation in the receiver is out of date or not up to par, as the detector output of the set is taken directly to the power amplifier, and the fact that the two are separated makes an ideal condition for improving the tone and performance of the dynamic speaker. Troublesome feed-back effects are also avoided by having a separate B-supply for the detector and r.f. stages, independent of the audio amplifier.

Reducing Hum in A.C. Receivers

One of the most troublesome causes of hum in a.c. receivers is found in the coupling in the circuit between the r.f. and detector stages. If the wiring is carefully cabled to avoid inductive coupling, there will be little hum, but, in many cases where space is limited and the parts are crowded together, loops will be formed in the circuit and a hum will result. While the gridleak-and-condenser method of detection is far superior in sensitivity and efficiency, the parts surrounding the gridleak and condenser, due to capacity coupling, often tend to make the receiver critical and unstable. In this case, changing the detector to the grid-bias type will sometimes eliminate the hum. If this does not remedy the trouble, connect a 100,000-ohm fixed resistor from the F-terminal of the r.f. transformer to the center tap of the filament-heating transformer. This resistor should be shunted by a .1-mfd. condenser. Another method of keeping down the hum is to connect the center tap of the filament winding, supplying the 227-tube, to 45-volt positive-B of the plate supply. This places a bias of from 22½ to 45 volts between the heater filament and the cathode of the tube. If the hum comes from the power stage, connect a 20-ohm center-tapped resistor across the filament supply and run the grid return from the center tap.—D. A. Brown, Marion, Ohio.

¶Popular Mechanics radio department offers its information service free to all readers of our magazine. We will be glad to help you with your problems, and will promptly answer all inquiries.

Simple Instrument Brings Your Receiver to Top-Notch Efficiency

MOST modern receivers employ ganged condensers, but, unless these are perfectly alined, the set does not perform as it should. While they may be alined by tuning in a station and then adjusting them until the point of greatest volume is reached, this method has limitations, owing to the natural variation in intensity of the music as received. If a signal of constant intensity could be produced for adjusting purposes, the job would be not only easier, but the alinement would be more accurate and, in many cases, it would be found that a remarkable increase in efficiency is apparent in the receiver after it has been adjusted by this method.

It is, in fact, a simple matter to make an inexpensive oscillator to supply constant signals, both r.f. and a.f., which the custom builder, service man or even the individual fan will find indispensable, since it can be used also for neutralizing receivers as well as for many other tests.

The schematic diagram for this oscillator is shown in Fig. 1 and the instrument layout in Fig. 2. All specifications are given except for the milliammeter, which is an inexpensive 0-to-10-milliamp. instrument, the use of which is optional. All instruments are mounted directly on the underside of the 3/16 by 8 by 9-in. bakelite panel. The case is 3 in. deep and may be made of 1/4-in. stock, glued and nailed together with small brads, after which it can be covered with imitation leather or stained and varnished as the builder may desire. Inexpensive cases of this type are obtainable at department stores.

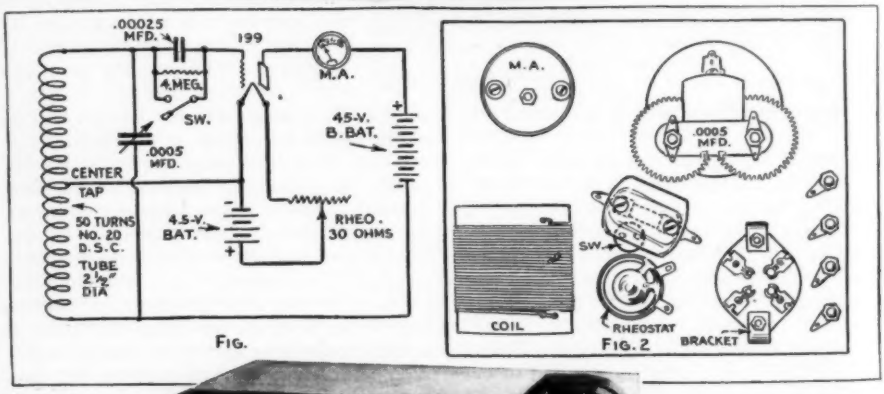


FIG. 1

FIG. 2

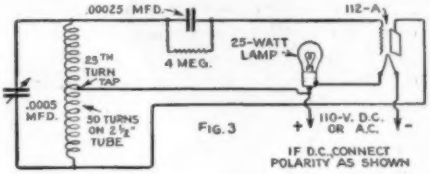
The coil consists of 50 turns of No. 20 d.s.c. wire, wound on a 2½-in. bakelite or

cardboard tube, 2¾ in. long. A tap is taken at the 25th turn (the center of the coil), and connected to negative side of tube filament. The coil should be placed at the end of the box so that close coupling to the set under test may be obtained; the .0005-mfd. condenser tunes this coil. A type-199 tube is used. A 4.5-volt C-battery with a 30-ohm rheostat, having an "off" point, in series with it, lights the tube, and the plate is supplied with 45 volts from two small 22.5-volt B-batteries. The four lugs shown at the right in Fig. 2 are for the battery binding posts, if the batteries are used externally, as shown in the photo above. If the builder desires, he may enlarge the case to contain the batteries.

The coil is fastened to the underside of the panel by means of two short machine screws at each end. The switch, a small battery type, is connected across the gridleak and condenser. When this switch is open, the condenser and gridleak will modulate the output of the oscillator to produce a.f. signals; when it is closed, the output is r.f. The tube socket is a subpanel type mounted with two brass brackets, 2⅜ in. long, made from two strips, 3⅜ in. long and bent over ½ in. at each end. This allows the socket to be mounted so far below the panel that the top of the tube, which projects through a hole in the panel, clears the top of the lid when it is closed.

This oscillator will cover from 550 to 1,500 kilocycles (545.1 meters to 199.9 meters) very efficiently. To aline ganged condensers all that is necessary is to switch on the receiver and remove the antenna lead from the set. The oscillator is then placed close to the antenna-tuning end of the receiver and switched on. The receiver dial is set to a low reading, such as 10 or 20 on a wavelength dial, or at about 1,300 kilocycles if so calibrated. The dial on the oscillator is then rotated until the signal comes through the loud speaker. The locknuts on the gang condenser are now loosened, and the individual condensers, from left to right, varied until the signal comes through with the greatest intensity. If trimmer or balancing condensers are employed across each condenser unit, use a spudger made of a piece of hardwood or bakelite sharpened to a screwdriver edge at one end for varying the adjusting screws, as shown in lower photo on opposite page.

If a visual reading of the receiver output is desired, instead of trusting to the ear, use the simple hookup shown in Fig. 4, consisting of a thermo-galvanometer



connected across the 6-volt secondary of a bell-ringing transformer. The 110-volt primary leads of the transformer are connected to the output of the set instead of the loud speaker. The instrument deflection will be at maximum when all stages of r.f. are tuned to resonance. The same hookup may also be used as an indicator when neutralizing a neutrodyne receiver, by adjusting the galvanometer deflection to a minimum at each stage.

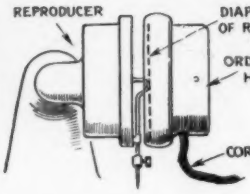
The oscillator may be calibrated in wavelengths or kilocycles and used as a standard to determine whether a certain receiver will cover the broadcast range sufficiently, and also to determine the degree of selectivity by using a distance of 4 ft. between oscillator and receiver as a standard.

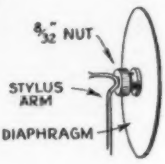
The diagram given in Fig. 3 is for a similar oscillator that is operated directly from a 110-volt a.c. or d.c. source.

Using Phone Line as Antenna

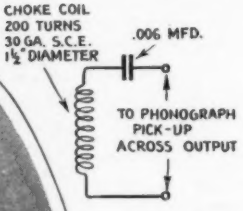
Telephone lines make a good temporary antenna when properly connected to the receiver. A .00025-mfd. fixed condenser of the mica type should be connected between the antenna binding post on the set and one of the telephone wires. Use whichever wire gives the best results. This arrangement allows the radio signals to pass to the set, but will not affect the telephone in any way. As a rule, it will not be necessary to use a ground.—G. Curtis Engle, Ridgewood, N. J.

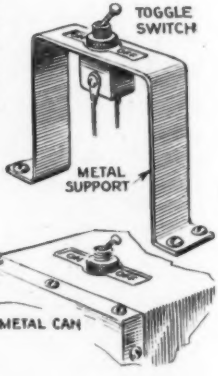
Helpful Tips *from*



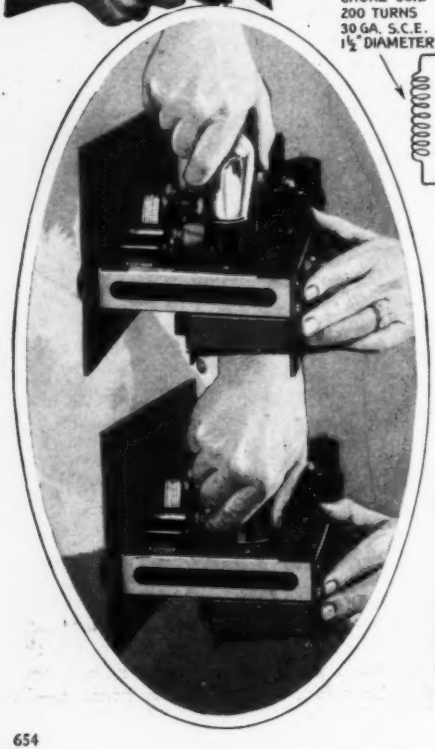


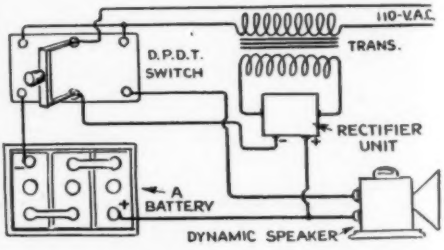
Left, Date Scribed on New Tube Bases for Checking Tube Life Also Prevents Possibility of Mixing Old Tubes with New; Above, Experimental Phonograph Pick-Up Made by Clamping Headphone to Phonograph Reproducer with Rubber Band; If Stylus Arm Does Not Touch Diaphragm, Use Brass Battery Nut as Shown; Phone Cord Goes to Detector Grid and Filament or to Audio-Amplifier Input





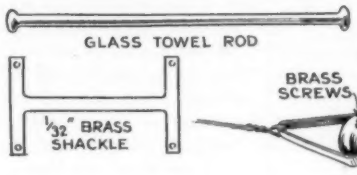
Above, Left, Simple Scratch Filter Removes Troublesome Record Scratch by Absorption; Right, Convenient Method of Mounting Switch in Power-Unit Shields; Can Be Removed without Disturbing Switch Connections; Lever Projects through Hole Cut in Can



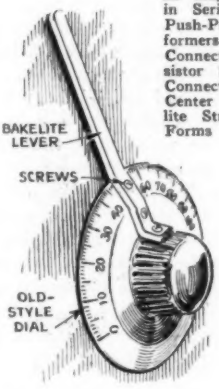


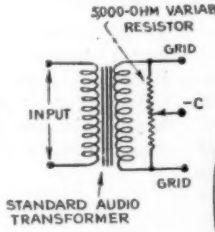
Left, Removing Tube from Socket, by Grasping Glass Bulb as Shown in the Upper Photo, Frequently Results in Broken or Damaged Tubes; Lower Photo Shows Proper Method of Grasping the Tube at the Base; Above, Operating a Six-Volt Dynamic Speaker from Trickle Charger to Save Drain on Storage Battery; Diagram Shows Connections for Switching the Trickle Charger from the Speaker Field Coil Back to the Battery for Charging When the Receiver Is Not in Use

the Radio Lab.

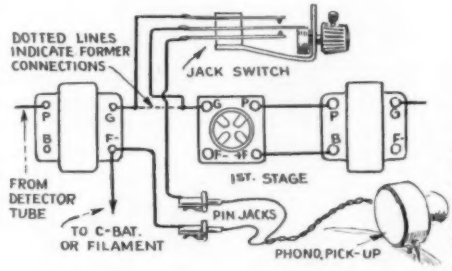


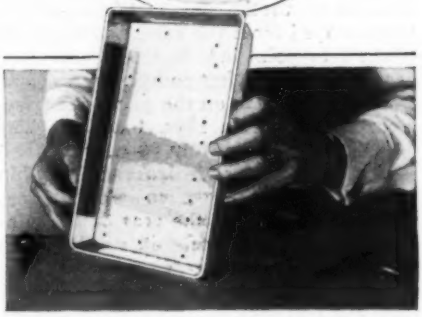
Inexpensive Antenna Insulators Made from Glass Towel Rods; Right, Checking R.F. Transformers by Means of an Adjustable Carborundum Crystal in Series with Headphones; Below, Push-Pull from Ordinary A.F. Transformers; the Output Transformer Is Connected in the Same Way, but Resistor Shunted across Secondary Is Connected to Plates of Tubes with Center Tap to Positive-B; Left, Bakelite Strip, Softened in Hot Water, Forms Lever for Vernier Tuning Dial



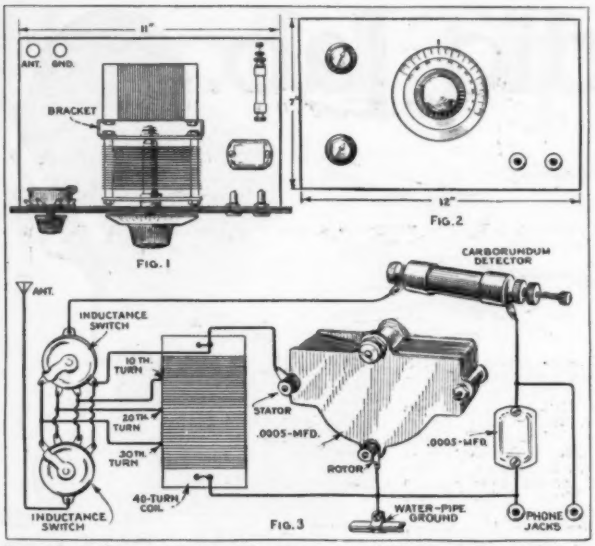


Right, Determining Magnet Polarity; South Pole Will Show Charge on Auto Ammeter When Passed Across behind Meter near Positive Terminal, Changing to Discharge as North Pole Approaches Negative Terminal





Handy Phonograph Pick-Up Switch Permits Quick Change from Radio to Record without Raising Cabinet Lid or Removing Tube; the Switch May Be Mounted at Any Convenient Position on the Control Panel; Right, Inexpensive Aluminum Baking Pans Make Excellent Bases for Mounting Radio Tuner or Amplifier Units; One Side of the Pan May Be Drilled to Take Binding Posts on a Bakelite Strip as Shown



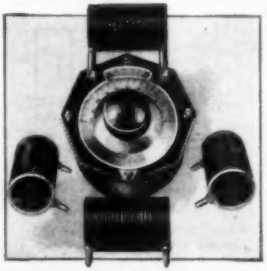
Upper Left, Instrument Assembly Showing Coil Mounted on Variable Condenser; Right, Front Panel Layout; Below, Simplified Wiring Diagram

An Efficient Crystal Set

This crystal receiver will give excellent results at low cost, and the beginner will find it very easy to assemble. The tuning coil consists of 40 turns of No. 22 or 20 d.c.c. magnet wire wound in a single layer on a cardboard tube, 4 in. in diameter and 5 in. long. The coil is tapped at the 10th, 20th and 30th turns, and about 1 ft. of the wire at each end of the coil is left for connections. The ends are anchored by running them in and out through the two small holes shown at the top and bottom of the coil. The taps may be taken off at the points specified by lifting the turn of wire at each point with a match or toothpick. The insulation is then scraped from the wire, and the leads to the four-point inductance switches soldered in place. After completing the coil, assemble the parts on the panel and baseboard as shown in Figs. 1 and 2. The latter may be made from ⅝-in. wood, and the instrument panel from either thin wood or bakelite. Two small brass brackets are used at the rear of the condenser to support the coil, as shown in Fig. 1. The two four-point switches are connected in parallel, as shown. The leads from the coil may be of the same wire as the coil, or of ordinary flexible rubber-covered hookup wire, as used for the remaining circuit connections. The carborundum-crystal detector is quite sensitive to weak signals, and, being adjustable, can be set at the highest point of efficiency. A single-wire antenna, at least 100 ft. long, should be used with this receiver for best results. Tuning is very simple; plug a pair of 2,000-ohm headphones into the phone-tip jacks, and rotate the condenser dial and inductance switches until a station is picked up. The crystal is then adjusted to a sensitive point, and the variable condenser and switches further manipulated to get maximum volume and clarity. The receiver is fairly selective and will separate stations nicely even in crowded localities, unless located in the immediate vicinity of a powerful local station.

Wavemeter for Short-Wave Sets

Four coils are used in this simple and compact wavemeter for tuning over the three most popular short-wave bands, 20, 40 and 80 meters, which cover everything between 19 and 91 meters. Coils for the 5 and 10-meter bands are also available.



The meter consists of a series of fixed and variable capacities built into a single unit, heavy jacks and plugs providing positive contact and facilitating quick changing from one wave band to another. The dial is of the vernier type, which enables reading to one-tenth of a division.

Converter for Operating A. C. Sets from Farm Lighting Plant

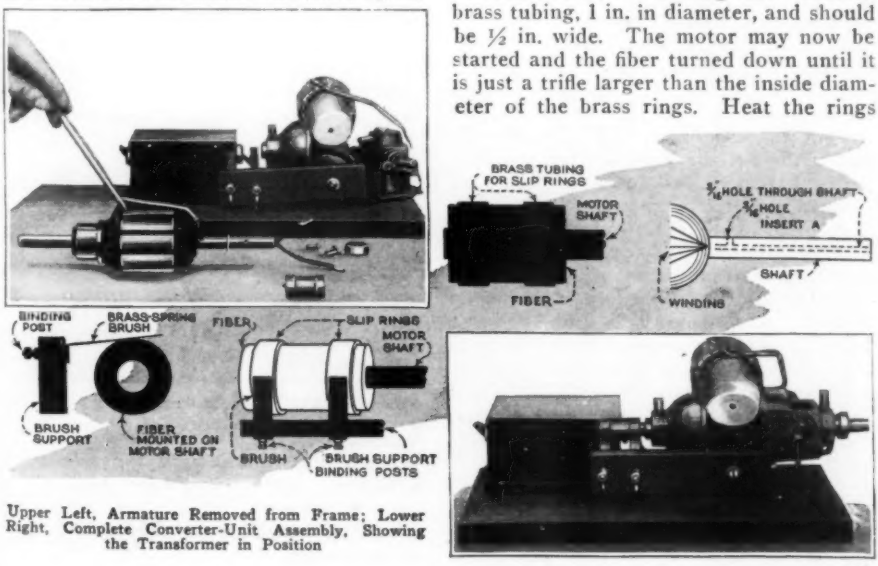
By D. A. BROWN

A ROTARY converter can be made from the average type of 32-volt motor to convert the d.c. supply of the farm plant into a.c. current for the operation of practically any standard a.c. receiver. To step up the output of the converter, a heavy-duty bell-ringing transformer, with the windings connected in reverse to usual practice, was used by the author. The device can be made to operate on either 32, 220 or 440-volt direct current as desired, so long as the motor voltage corresponds with the line voltage.

It is preferable to use a four-pole shunt-wound motor, as the driving speed will only have to be 1,800 r.p.m., while a two-pole machine will have to make 3,600 r.p.m. However, there is no objection to the latter if the bearings will allow such speed without overheating. The connections of the armature will be the same in both cases, proceeding as follows: Mark the bars of the commutator on which the brushes rest when the motor is idle; these will serve as guides later. Remove the armature from the frame and drill a 3/16-in. hole down the end of the shaft opposite the commutator end, meeting it with another hole as indicated at A in the drawing. Through this hole the wires are brought from the commutator to the slip rings.

It will be found that wooden or fiber wedges are used in the armature slots to hold the windings in place. Remove the wedges in line with the commutator bars previously marked, solder a small well-insulated wire to each of the marked bars, then run the wire through the slots in the armature from which the wedges were removed, taking them down through the hole in the shaft and out of the end. Replace the wedges and tape the end of the armature winding where the wires are fastened to the commutator, then wrap firmly with heavy cord and cover with black asphaltum insulating varnish. Let this dry thoroughly and then reassemble the motor.

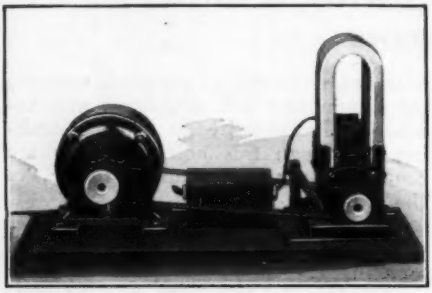
The slip-ring assembly is made by drilling a fiber block to a snug driving fit on the motor shaft. The rings are cut from brass tubing, 1 in. in diameter, and should be ½ in. wide. The motor may now be started and the fiber turned down until it is just a trifle larger than the inside diameter of the brass rings. Heat the rings



Upper Left, Armature Removed from Frame; Lower Right, Complete Converter-Unit Assembly, Showing the Transformer in Position

and slip them in position on the fiber, where they will fit tightly when cold.

The two wires from the commutator



Magneto Driven by Motor Used to Furnish A.C. Source for Step-Up Transformer

are then connected to the rings, one being turned over the end of the motor shaft and connected directly to the ring, while the other is slipped through a small hole drilled in the fiber so that the wire can pass under the ring with plenty of clearance. Two brushes, made of hard spring brass, are then mounted on a fiber block which is attached to the motor frame, so that the brushes will bear against the slip rings, as shown in the sketch at the lower left. The method of mounting the block depends on the type of motor used. The unit is now a converter, and by connecting it to the farm-lighting battery supply, it will supply a.c. current from binding posts fastened to the brushes. The voltage is usually five-sevenths of the input battery voltage, and, in average operation, the output will be between 22 and 28 volts a.c., depending on the condition of the batteries that furnish the driving current.

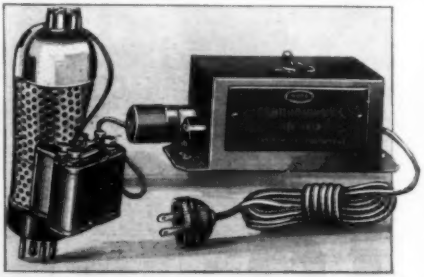
In the writer's experiments a heavy-duty bell-ringing transformer, with a 110-volt primary and a 24-volt secondary, was used, the current rating being from 150 to 200 watts. The secondary of this transformer is connected to the slip-ring brushes of the converter and a voltage sufficient for the operation of a standard a.c. receiver is obtained from what was originally the primary of the transformer.

The voltage from the transformer should be checked with an a.c. voltmeter, and, if found too high, a suitable resistor should be placed in the receiver supply line. The usual voltage control devices are suitable for this purpose.

Another interesting experiment along the same line for those who have no suitable motor, or who wish a simpler design, employs a heavy-duty magneto, such as used on older types of autos for ignition. While the converter can be built into one compact unit, the magneto type must be driven with a separate motor. The frequency is governed, as in the case of the converter, by the number of poles in the machine, although, as a general rule, the magneto will be of the two-pole construction. The transformer requirements vary with different machines, so the voltage output will have to be determined by means of a meter and a suitable transformer used for the particular voltage desired.

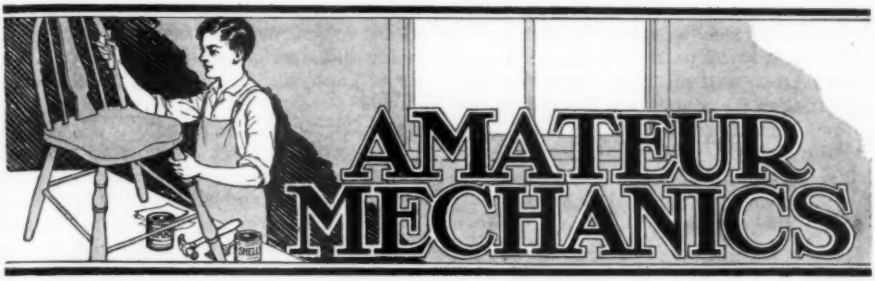
Adapter Makes Screen-Grid Tubes Usable in Any Set

Enabling an owner of any type of receiver to convert the set to use the new screen-grid tubes, an adapter is said to build up stronger signals, give greater DX-reception, quieter operation and better selectivity. It is designed to permit the use of 224-tubes as r.f. amplifiers in place of 201A, 226 or 227-tubes in any receiver where there is room for it. A 110-volt a.c. supply is necessary for the filament transformer, and a plate supply of from 135 to 220 volts. The device consists of a high-impedance coupler for use in the plate circuit, a self-adjusting screen-grid bias unit, complete shielding



Screen-Grid Unit Ready for Plugging into Power Line

and a two-outlet filament transformer, the latter being unnecessary for sets using 227-tubes. One transformer suffices for two or more r.f. tubes. The adjustable revolving base fits a standard four or five-prong socket.



A Smoking Stand of Real Utility

By FRANK L. WADE

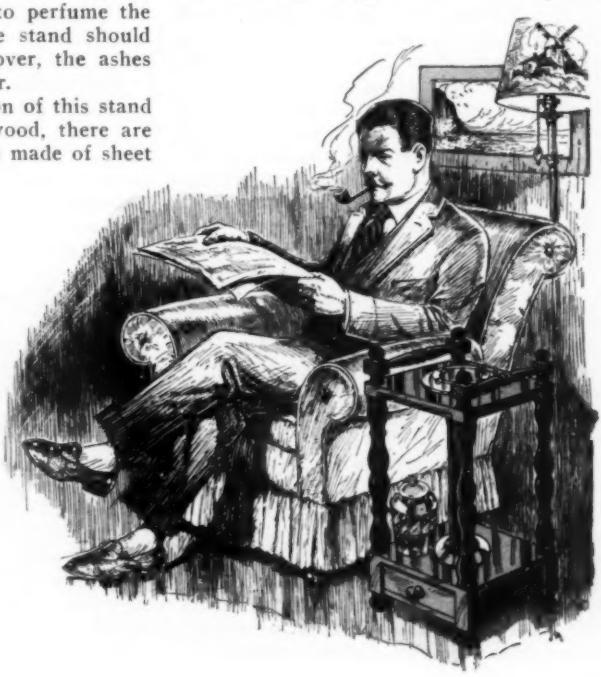
ONE of the commonest projects for the home worker to make is a smoking stand. To the general mind, a smoking stand is good or bad only by virtue of its pleasing (or otherwise) appearance, and it is seldom judged by its utility. In this article we present a stand which is not only very pleasing in design, but is extremely useful. It has two distinct features in its favor. First, should a lighted cigar or cigaret be dropped into it, the smoke will not continue to perfume the room, and, second, if the stand should accidentally be knocked over, the ashes will not scatter on the floor.

Though the main portion of this stand is to be constructed of wood, there are three parts which must be made of sheet metal; these parts, however, are so simple that any handy man can easily construct them.

The stand consists of four turned legs, two handles, two shelves and a drawer, as well as rails, stretchers, etc., of wood. It also has a sheet-metal funnel, cylinder and square pan. Detail drawings of each part are given, and if the dimensions are carefully followed, no difficulty need be experienced.

The design of legs and handles may be altered to suit the workman except for the over-all length and the square portions where the drawer and the shelves are placed. The sizes given must be followed here.

The hardest part of the job is turning the legs and handles exactly alike. This will be more easily accomplished if a template, or rather, two templates are first made, one for marking and the other for shaping. The templates for the legs are made from ¼ by 2-in. pieces of wood, and are 28 in. long; the handle templates



are the same, but 12½ in. long. Detail drawings of the leg templates are given.

The first thing to do is to lay off all the dimensions, starting 1 in. from the end, and at each point square a line across one side and one edge of the template. Then, standing the template on its opposite edge, drive 1-in. brads into the marked edge at each point until they project only ¼ in.; the heads are then filed off to a fairly sharp point. This template is used by holding the bradded edge against the stock while it is turning in the lathe, which marks the location of each cut.

The shaping template is merely a pattern of the leg, cut out on the band or jigsaw or even with a coping saw. At the square portions of the leg, allowance must be made in the template for the distance across corners of the stock. This template is held against the stock from time to time while turning it, to determine if the leg fits the pattern. The handle templates are made and used in a similar manner, the design serving as a guide.

The stock for the legs is 1½ in. square, 28 in. long, and four pieces will be required.

After turning, the legs must be bored to fit the handles and mortised to fit the rails and stretchers. In the detail drawings of the legs, the exact size and location of these various holes will be found. Be very accurate in the measuring and cutting, as much depends on the way the pieces fit together. Note that 3⅛ by ½-in. mortises are cut on one side of the squares at the bottom of the front legs, for the side rails, while on adjacent sides the tenons are ⅜ by ⅝ in., for the front lower stretchers, as shown in the lower sketch of the leg. On the back legs, 3⅛-in. mortises are cut in both sides, as the back rail is the same as the side rails. The mortises at the top are all alike.

Two shelves will now be required, each measuring 12½ by 12½ by ⅝ in. Locate the exact center of each piece and, in one piece, cut a hole, 4 in. in diameter; in the other cut a hole, 2½ in. in diameter. In each corner of each shelf cut a square notch exactly 1½ by 1½ in. Dress all outside edges and surfaces perfectly smooth. Rails and stretchers are then cut according to the details and placed where shown on the assembly drawing.

In constructing the drawer, follow the common practice of drawer construction, using the sizes shown in the drawing. A small knob may be turned if desired, or it can be purchased at any five and ten-cent or variety store.

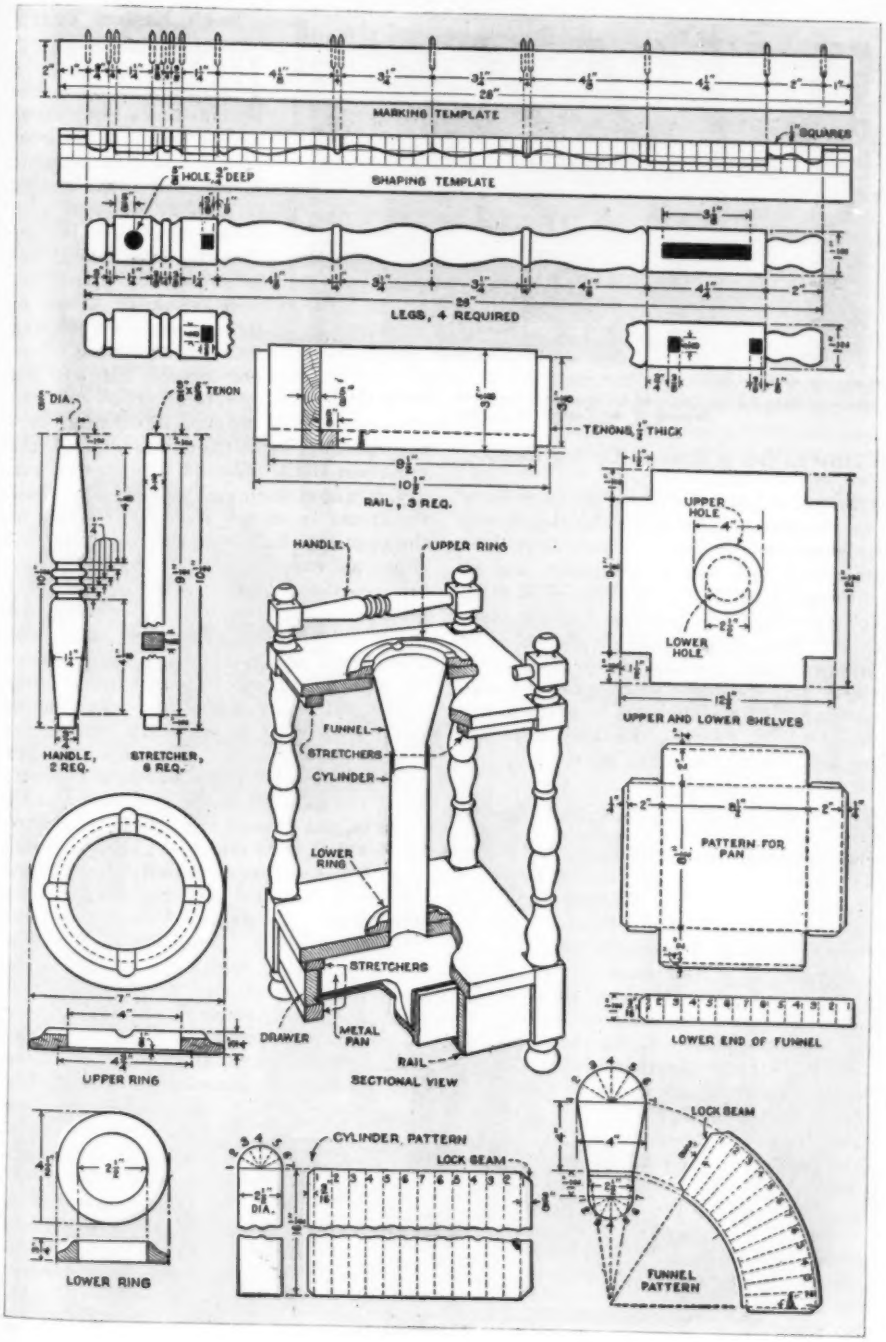
Two wooden rings are now turned, one to fit around the cylinder, where it enters the lower shelf, and the other to fit around the opening in the upper shelf. Sizes and shapes of these rings are given in the drawings. The upper ring is to have four grooves gouged in it, in which to lay cigars or cigarets.

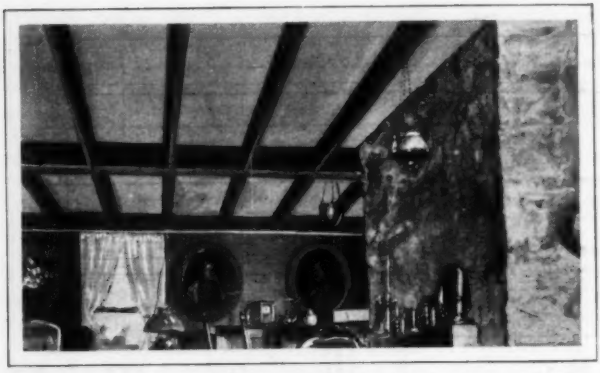
If the worker cannot make up the funnel, cylinder and pan, any sheet-metal shop will make them, from the patterns given, for a very small sum.

In assembling the various parts, the pair of legs on each side should be glued and clamped together with their handles, stretchers and rails and allowed to remain in the clamps until the glue has thoroughly set. The two sets of legs thus obtained are to be assembled with the crosswise stretchers and rails and again clamped until the glue has set. The shelves are then put in place and need not be fastened unless it is desired, though it is better to fasten them from the underside to prevent the possibility of warping.

The funnel and cylinder are soldered together, allowing the cylinder to overlap the funnel to the point where the flare begins. This whole unit is then inserted down through the hole in the upper shelf, through the lower ring and into the hole in the lower shelf until the flange of the funnel rests on the upper shelf. The upper wooden ring is then fastened to the upper shelf over and hiding the flange of the funnel. The sheet-metal pan forms a removable lining for the drawer to prevent any danger from fire and must always be used for that purpose.

The stand is now completed and ready for the finishing. It will probably be desirable to finish the stand to match some other piece of furniture, so it will not be necessary to give processes in this article. If such woods as mahogany, maple or walnut are used, the finish will naturally be stain and varnish or shellac. If a lacquer or enamel finish is desired, then cheaper woods can be employed. Gum and birch, in this class, are good for turning.


MARKING TEMPLATE
SQUARES
HOLE, DEEP
SHAPING TEMPLATE
LEGS, 4 REQUIRED
DIA.
TENON
TENONS, THICK
RAIL, 3 REQ.
UPPER HOLE
LOWER HOLE
UPPER AND LOWER SHELVES
HANDLE
UPPER RING
FUNNEL
STRETCHERS
CYLINDER
LOWER RING
PATTERN FOR PAN
HANDLE, 2 REQ.
STRETCHER, 6 REQ.
DRAWER
METAL PAN
RAIL
SECTIONAL VIEW
LOWER END OF FUNNEL
UPPER RING
LOWER RING
CYLINDER PATTERN
LOCK SEAM
FUNNEL PATTERN



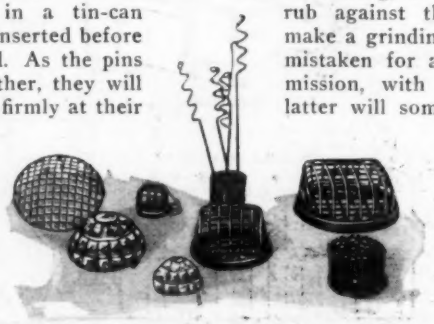
Beamed-Ceiling Effect, Obtained by Exposing the Joists, Adds to the Attractiveness of the Cottage or Lodge

How to Get a Beamed-Ceiling Effect

To get a beamed-ceiling effect, remove the plaster and laths on the ceiling thereby exposing the joists. They should be smoothed with coarse sandpaper, and all holes must be filled. Wallboard is fitted between the joists and tacked at the edges to the floor or roof boards above. The rows of nails holding the wallboard in place are covered with quarter-round molding. The wallboard is painted any desired light color while the joists are stained with dark-walnut oil stain.

Wire Holders for Long-Stemmed Flowers

When long-stemmed flowers are placed in shallow vases or dishes, or in wide-necked jars, the wire supports shown in the photo will be found handy. One of them consists of a group of hair pins set vertically in a lead base. The lead is melted and poured in a tin-can cover, the pins being inserted before the lead has hardened. As the pins are placed close together, they will hold the flower stems firmly at their base. If an additional support is desired farther up the stem, place a few long, twisted and looped wires in the cluster of hairpins. Other supports of wire and screen are also shown.



Simple Methods of Supporting Long-Stemmed Flowers in Shallow or Wide-Necked Containers

Don't Neglect Your Generator

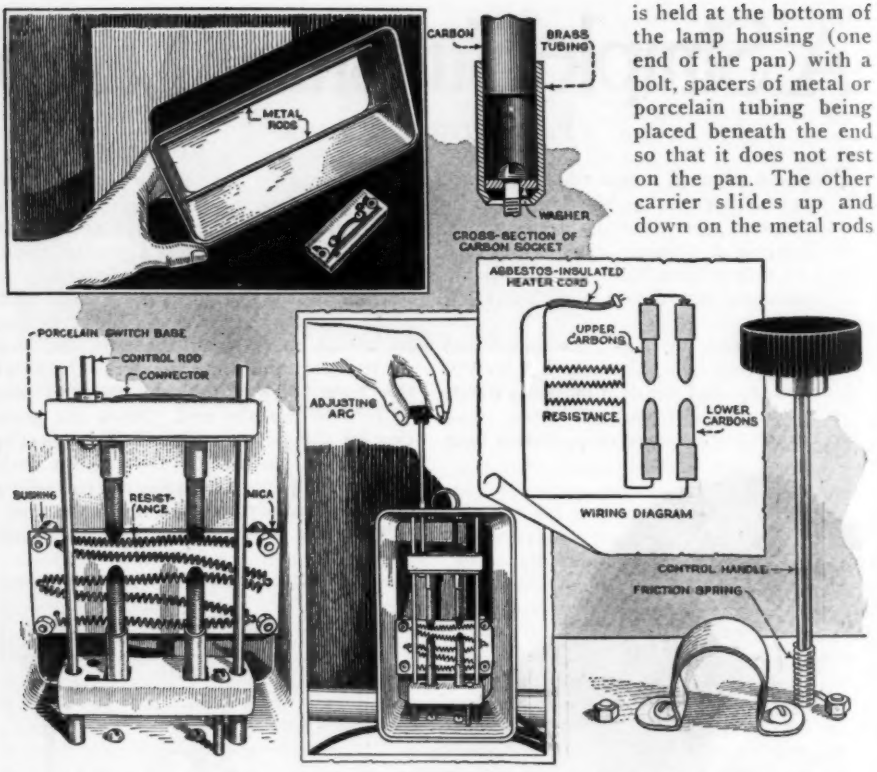
One of the most important units of an automobile engine is the generator. If you examine it, you will notice a little oil cup at the rear end. Being small, it is frequently overlooked, but it should be supplied with several drops of light oil once a week, and more often if long drives are made. On a Ford generator this oil cup supplies lubrication to a ball bearing supporting one end of the armature shaft. Should this bearing run dry, it would soon go to pieces and allow the armature to rub against the inside of the generator housing. This would necessitate an expensive repair and, perhaps, an annoying delay, so that it is well to give this unit the attention it requires and shield it as much as possible from dust and dirt. Sometimes a film of gummy oil will collect on the commutator, preventing the generator from charging as it should. When this occurs, it is necessary to clean the commutator with a fine grade of emery cloth or garnet paper. With the motor running idle, hold a small piece of this against the commutator until the film has been removed. The generator should then charge properly, but if not, take it to the local service station for examination. To neglect the generator is to invite trouble. Sometimes a burned-out ball bearing, which lets the armature rub against the field pieces, will make a grinding noise that is easily mistaken for a noise in the transmission, with the result that the latter will sometimes be needlessly overhauled. The generator should never have an output of more than 15 amperes, as a high-charging rate is hard on both battery and generator.—Glen F. Stillwell, Collinsville, Ill.

A Simple "Sunshine" Lamp

By WALTER E. BURTON

FOR the price of a box of good candy you can have a "health" lamp as efficient as one costing many times more. The lamp is a twin-arc type, using two pairs of either "sunshine" or therapeutic "C" carbons, and the cost of operation is low.

The lamp housing is an aluminum bread pan measuring approximately 5½ by 9½ in. at the top, and nearly 3 in. deep, which can be obtained for about 25 cents. The two carbon carriers are of porcelain, and are bases from single-pole, single-throw knife switches, purchased for 10 cents each. Remove all metal parts, and on one side of one piece mark a center point. Likewise, run a center line from top to bottom of the bread pan, on each end. Place the marked porcelain piece so that its center mark coincides with the line on the pan, and aline the screw holes of the base halfway between the top and bottom of the pan end. Mark the position of the holes, and drill through the pan with a 7/16-in. bit. Do this on both ends of the pan. The holes are to receive the two parallel rods upon which the movable carbon holder slides, and on which



is held at the bottom of the lamp housing (one end of the pan) with a bolt, spacers of metal or porcelain tubing being placed beneath the end so that it does not rest on the pan. The other carrier slides up and down on the metal rods the other one rests. The rods are made from the solid portion of a sectional curtain rod, cut to size and threaded at each end to receive nuts.

Prepare each of the carbon carriers as follows: Obtain four pieces of metal tubing, about 1 in. long and having an internal diameter nearly the same as the outside diameter of the carbons to be used. Those illustrated are 5/16 in. If the tubing is too small to receive the carbons, spread one end slightly with a tapered punch. If it is too large, bend the edges in with a hammer or pliers. Then insert a solid-metal rod or other solid object into the tubing so that the end comes within a fraction of an inch of the base end of the piece. With a hammer, burr over this end so that a washer, when slipped inside, will not pass through. This is to make possible bolting of the piece to the porcelain base.

One carbon carrier is stationary, and running lengthwise of the pan. The two carbon sockets of the sliding piece are connected by a piece of heavy copper wire. There are six holes in each porcelain piece. Two of these hold the carbon sockets and two slide over the parallel rods. Of the remaining two, one is employed for fastening the bottom carrier, and the one in the sliding unit receives the adjusting handle. This is a rod running through a hole in the top of the housing, and is fitted with a radio knob at the upper end. To prevent the sliding carrier from dropping down, a short coil spring, bent sharply so as to have a friction grip when in place, is slipped over the handle, as shown in one of the drawings. One end of the spring is held by the nut on the nearest rod. The spring creates friction on the control rod so that the carrier will remain in any position to which it is set. A small metal handle, also shown, is bolted to the top of the lamp housing.

A resistance is required for the arc. This consists of a length of coiled resistance wire—half of that on a 550-watt heater element is about right—mounted on a rectangular mica sheet, which, in turn, is fastened by means of bolts and spacers near the rear side of the lamp housing, behind the lower carbons. The mica is backed with a sheet of asbestos, although this can be omitted if all wires are arranged so as not to touch the metal. The resistance wire can simply be wound around the mica piece, but it is best to place the wire on the outside surface of the mica, in the manner illustrated. The resistance is held in place by staples made of short pieces of the same wire, clinched through holes in the mica. By mounting the resistance unit inside the housing, two advantages are gained. First, it is out of the way and is protected from damage; second, the heat produced is directed toward the lamp user, a not unwelcome feature on a chilly day.

The lamp may be provided with a base in any of a number of ways. It may be screwed to a square wooden block, suitably finished. The lamp illustrated uses the base from an old radio loop aerial. This happened to have a hole in the center, so a bolt fitting it was fastened to the lower side of the housing. This allows the lamp to be turned easily.

Power wires enter the housing at the back, near the bottom. One wire goes to one side of the resistance and the other to one of the lower carbons, as shown in the wiring diagram. The second bottom carbon is connected to the other resistance terminal by heavy copper wire, either bare or enameled. A piece of mica should be inserted so as to keep some of the heat from the lead wires.

A standard-length carbon is broken in half to form one pair for the lamp. The pieces are inserted into their sockets so that a tight fit is obtained, and the lamp is ready to operate. After connecting it to a 110-volt current supply, the arc is started by bringing the carbons together and then separating them slightly. Be sure that both pairs of carbons touch at the same time.

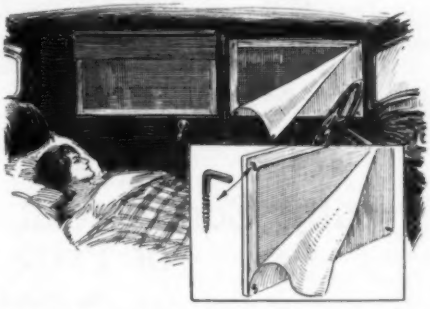
It is necessary to use goggles with this lamp, in order to protect the eyes from injury. These should have colored glass mounted in close-fitting leather, so that rays of ultraviolet light cannot reach the eyes from the sides. You usually can obtain them from physicians' supply stores.

First exposures to the lamp should be brief, two or three minutes a day at most. This can be gradually increased in length as the skin becomes tanned, but too long exposures are likely to produce painful sunburn. The lamp will burn five to ten minutes with one setting of the control handle, a feature that prevents overexposure if the user happens to fall asleep.

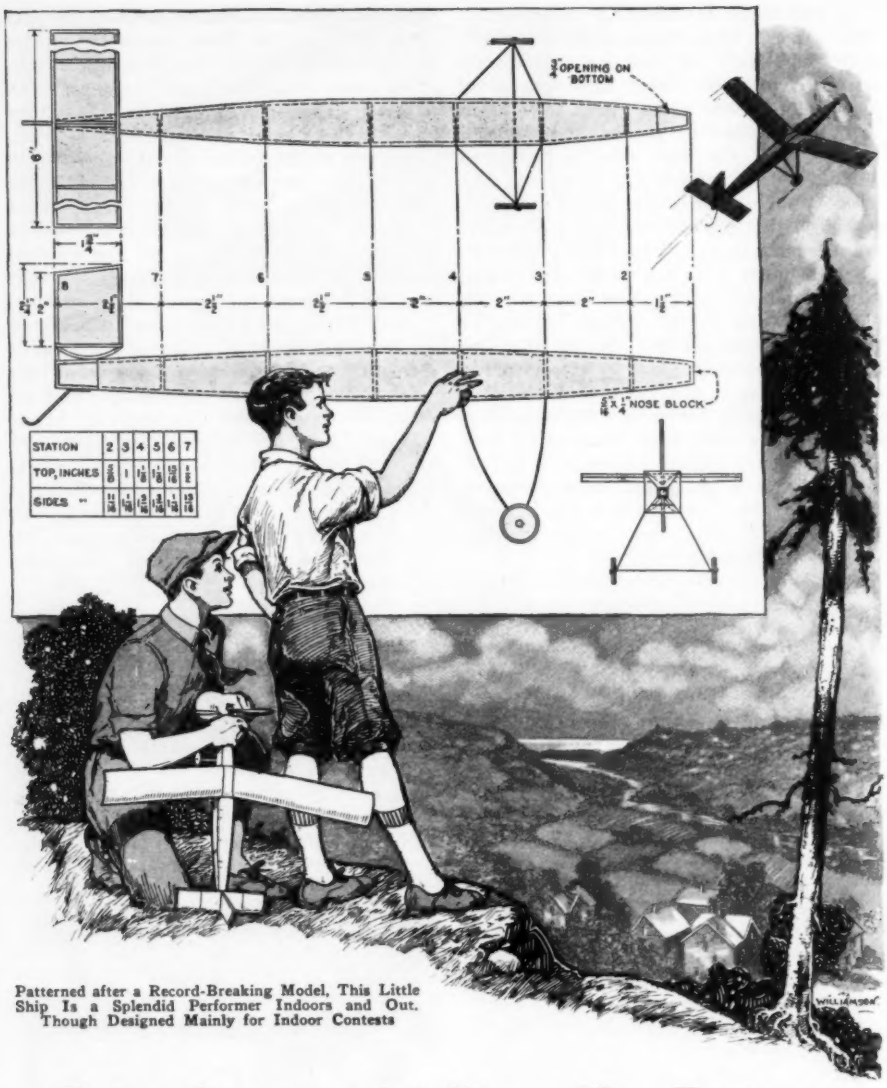
But before using this or any other kind of health lamp, it is a wise precaution to consult your physician to determine the advisability of such treatment, and to learn the length and frequency of exposures. There are some persons who are harmed rather than benefited by short-wave radiation, and illnesses in which it is dangerous. The "C" carbons are rich in ultraviolet rays and are suggested for use under a doctor's directions. Sunshine carbons are less powerful.

Combined Screens and Curtains for Auto Windows

For those who occasionally sleep in their cars on week-end camping trips, beach parties, etc., the combined screens and curtains shown in the drawing will be found a great convenience. The screen frames are made of light wood to fit the windows and the curtains may be of the spring-roller type, or simply pieces of suitable cloth fastened to the screen frames by means of hooks. The curtains are useful as sunshades.



Combined Screens and Curtains for Car Windows Are Found Convenient by Campers



Patterned after a Record-Breaking Model, This Little Ship Is a Splendid Performer Indoors and Out. Though Designed Mainly for Indoor Contests

Baby Commercial Plane Has Features of Prize Winners

By JOHN McLEAN

EVERY model-plane builder who knows of the records of Ernest McCoy and Aram Abgarian knows of the success of the cambered wing with the reverse-camber stabilizer. An excellent baby indoor commercial model can be constructed around these features. The model described here includes, with slight alterations, those used on Abgarian's record-breaking tractor. The fuselage length of

15 in. is the same as Abgarian's motor stick. The wing is 19 in. long and has a 1-in. center section.

With its motor wound to only three-quarter capacity, one of these planes has risen from the ground and remained in the air for 41 seconds. With a good propeller, it should be able to remain up over one minute.

This ship is a rather difficult job and is recommended only to the builder who has had considerable experience. If properly constructed, it will repay any efforts or money expended. Remember that one should be thoroughly familiar with the drawings and directions before starting the work.

Balsa is the chief material used. For the fuselage you will need three strips, 3 ft. long and 3/32 in. square, also a propeller block 7 or 8 in. long, 1¼ in. wide and ¾ in. thick. Two pieces of balsa veneer are needed, one 2 ft. long, 1 in. wide and 1/16 in. thick; the other 6 in. long, 2 in. wide and 1/32 in. thick. Only two pieces of bamboo are used, a short sternpost and the tail skid. As considerable piano wire is used, you will need about 2 ft. of .012-in. wire and several inches of a larger size, about .020 in., also a small aluminum washer, two small glass beads and a sheet of superfine silk tissue. The rubber motor is of two strands of 3/16 by 1/32-in. flat rubber, about 29 in. Adhesives used are ambroid and banana oil, or airplane dope.

The most difficult piece of work is the fuselage. Two of the 36-in. strips are cut into 15-in. lengths. The resulting four strips are each sanded down to 5/64 in. square. The third strip is sanded and cut into struts of the lengths given in the table. Each longeron has a small notch in one end so that, when assembled, they form a small slot for the sternpost. Two longerons and the necessary struts are assembled to form each side of the fuselage. While the cement is drying, make the nose block and the sternpost. The nose block is of balsa, 5/16 by ¼ by 1/16 in., with notched corners. The sternpost is of bamboo, 5/8 by 3/64 by 1/32 in. The aluminum washer is cemented onto the nose block.

When all cement is dry, complete the frame by joining the two sides and adding nose block and sternpost. Then cover, leaving a ¾-in. opening in the tail at the bottom, and a 1-in. opening in the tail side. If necessary, dope the paper.

Now construct the landing gear. The tail skid is of bamboo, bent over a candle flame, and cemented on at the junction of the lower longerons. The wheels are two 5/8-in. balsa disks, 1/32 in. thick, cemented together. The landing struts are of .012-in. piano wire, bent with a small loop at the bottom of each pair, to take the 4½-in. axle. Carefully straighten this piece, slip it through the loops in the struts, put on the wheels, bend a "U" on each end of the wire, force back into the wheels, then cement. When dry, force the ends of the struts into the lower longerons at stations 4 and 5. Adjust the undercarriage and cement the struts in place.

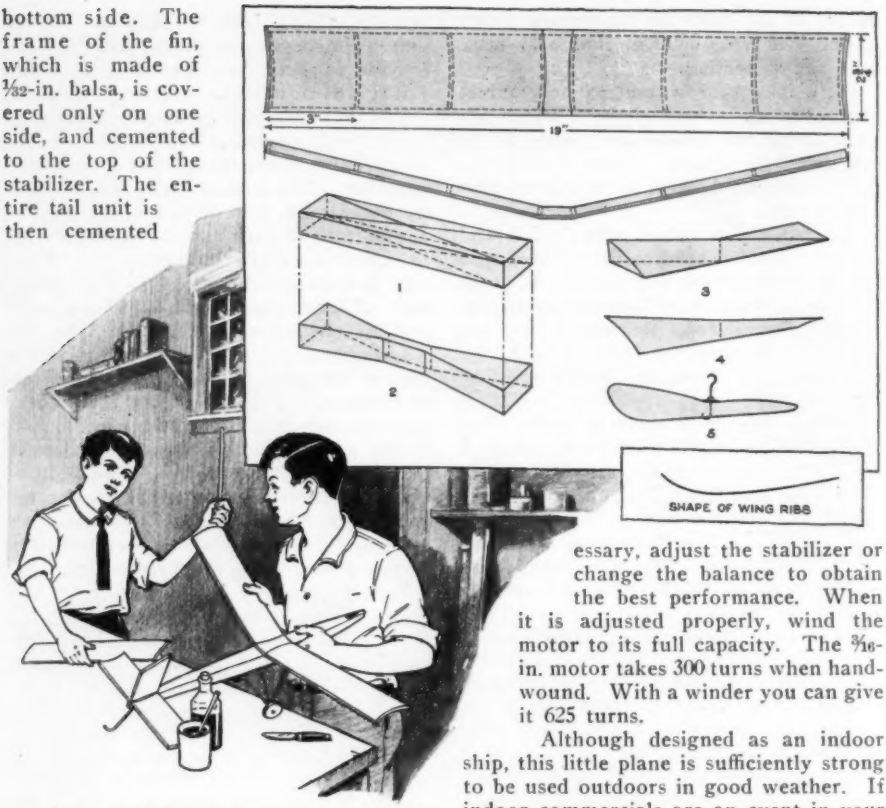
The success of this model is in great part due to the cambered wing, consequently this member should be made carefully. For a contest model, tapered wing spars are recommended, as they not only decrease weight but also resistance.

Split off the two 19-in. spars from the 1/16-in. veneer, cutting against a straightedge. Taper the spars from 1/8 in. at the middle to 1/16 in. at the tips. Sandpaper lightly, thinning the spars slightly at the ends. Cut the spars at points 9 in. from each end, and cement together to form 2-in. dihedral angles. To make the ribs, a piece of 1/32-in. veneer, about ¾ in. wide and 2¾ in. long, is bent to about the curve shown. Steaming will be found to be the best way to bend the balsa. If necessary, however, the wood can be soaked, bent to shape and dried in that position.

Split off the eight ribs slightly wider than necessary and sand to 1/16 in. Trim off the ends to make them 2⅝ in. long. The ribs are cemented on the spars at 3-in. intervals. When the cement is dry, cover the wing on the top with tissue. When covering, be sure to give the wing "wash," that is, bend one wing tip up and the other one down to compensate for propeller torque.

The stabilizer is not difficult to construct. The spars are split from the 1/16-in. veneer and sanded to 1/16 by 3/64 in. The reverse-camber ribs are perfect arcs, 3/16 in. deep. A piece of the 1/32-in. veneer is bent and the ribs split off and sanded, then cemented to the spars at 1½-in. intervals. The stabilizer is covered on the

bottom side. The frame of the fin, which is made of 1/32-in. balsa, is covered only on one side, and cemented to the top of the stabilizer. The entire tail unit is then cemented



to the top of the fuselage with a 1/16-in. block under the front spar and a 5/16-in. block under the rear spar.

The final job is the propeller. The drawings show the steps in carving a Langley true-pitch prop. A fairly low-pitch propeller will be found most efficient on this model. The length should be 7 or 8 in. The propeller shaft is of .020-in. piano wire. Bend the hook first. Force the shaft through the bearing on the nose block, slip on the beads, run through the propeller, bend over the wire and cement. Make an S-hook of .020-in. wire. Put in the two-strand motor, looping the rubber over the front hook and the S-hook. Leave about 1/8-in. slack, and clip off any excess rubber.

Fasten the wing lightly with a rubber band or thread. Glide the ship until you obtain proper balance. For the first flight, wind the motor about 200 turns. If necessary, adjust the stabilizer or change the balance to obtain the best performance. When it is adjusted properly, wind the motor to its full capacity. The 3/16-in. motor takes 300 turns when hand-wound. With a winder you can give it 625 turns.

Although designed as an indoor ship, this little plane is sufficiently strong to be used outdoors in good weather. If indoor commercials are an event in your next local contest, build one of these little ships and be prepared to take home a ribbon.

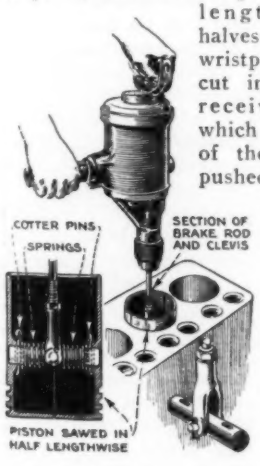
Painting of Plaster Walls Requires Special Care

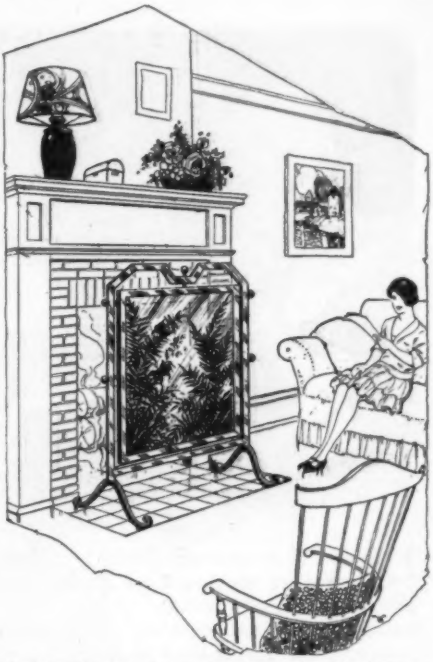
More paint is needed to cover a plastered surface than a wood one as the former is more porous. Paint should not be applied to plaster until it is perfectly dry. The first coat should consist of white lead and oil, to which has been added one teaspoonful of japan drier for each pint of paint in order to insure it drying hard. Before applying the first coat, fill all the holes in the wall with plaster of paris, or patching plaster obtainable at paint and hardware stores. All dark-colored, damp or moldy spots on the surface of the walls should be given a coat of shellac before sizing. Next apply a coat of glue size,

which will reduce the absorption of paint. After the size is thoroughly dry apply the first coat of paint and after this the successive coats of the desired finishing shade. Always allow plenty of time for each coat to dry before applying another. Buy ready-mixed paint of the best grade if a durable job is desired. Instructions for mixing the size, etc., can be obtained from any paint dealer. It is rarely necessary to use more than two coats of paint on a wall properly sized. There are many kinds of wall finishes both in gloss and in flat. No matter what color you select for the ceiling of a room, be sure that it is a shade or two lighter than that of the walls. By adhering to this rule you will prevent a top-heavy appearance, which is depressing. If you are not familiar with the right combinations you can get a color chart from the paint dealer. This will also give information concerning colors suitable for rooms of different exposures.—Francis W. Henry, Pottsville, Pennsylvania.

Cylinder-Lapping Tool Attached to Power Drill

Operated by means of a power drill, the improvised lapping tool, shown in the drawing, has been found highly satisfactory. It consists of a piston, cut in half lengthwise. Both halves are pinned to a wristpin, and slots are cut in the latter to receive cotter pins, which allow the halves of the piston to be pushed together or pulled apart a short distance. To the center of the wristpin a driveshaft is pinned at right angles, as shown in the detail. Coil springs are slipped over the wristpin at the points indicated to force the piston tightly against the cylinder wall while lapping.





Artistic Fireplace Screen Consisting of a Metal Frame and Glass Panes Holding Ferns

Novel Fireplace Screen

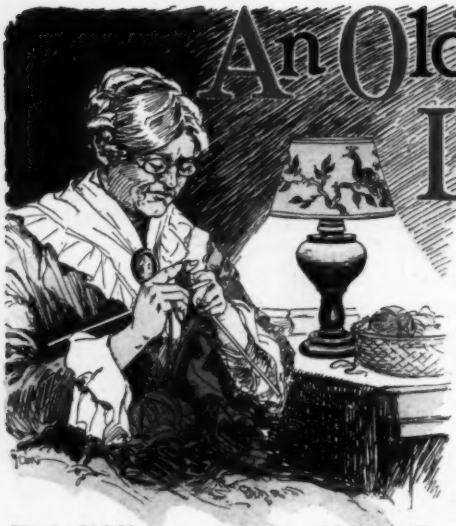
One of the most attractive fireplace screens I have ever seen consists of a metal frame in which two large window panes are mounted. On one of the glasses an artistic arrangement of mountain ferns, autumn leaves, some grasses and a few butterfly wings, were glued, and the glass panes were then cemented together to exclude the air.—Juliette Frazier, Forest Grove, Oreg.

Making Speed on Muddy Roads

An interstate bus driver who works on a schedule and therefore has no time to waste, has hit upon an effective method of getting over slippery, muddy roads in record time. Instead of shifting gears for an hour or so in a vain effort to get out of a bog, he immediately releases about one-half of the air from the two rear tires. This allows the tires to flatten out and provides much more traction than ordinarily. After he has passed the muddy stretch, the tires are again inflated.

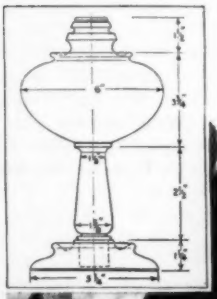
An Old-Fashioned Lamp

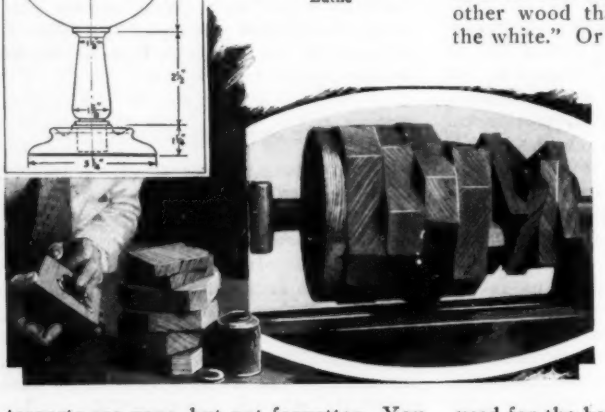
by D. R. VAN HORN



DO YOU remember the old coal-oil lamp that mother kept bright and clean for company? Or the one that stood on the kitchen table? We used to peer up from our books and imagine that we could see the fuel traveling up the wick. Every line and curve and bulge stands out clearly.

Today that lamp and its million counterparts are gone, but not forgotten. You can quickly fashion a duplicate from the pattern in your memory. Not to burn coal oil, of course. It is made from walnut or other choice woods and is wired for a single electric light that rests within a socket on top. With a suitable shade, it is presentable anywhere, as the illustrations show. A lamp like this serves several good purposes. It will bring back a touch of youth; it is a thing of beauty, and it is quite in keeping with the modern trend in home furnishings. Make one, finish it nicely and you will be proud to own it.



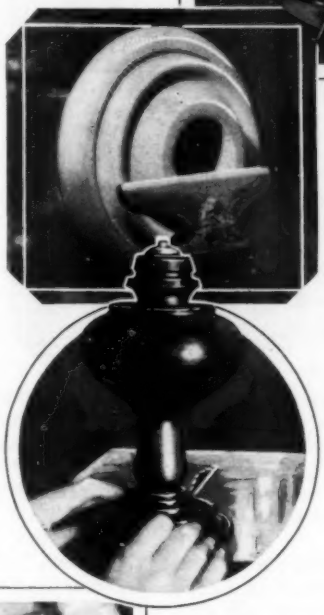


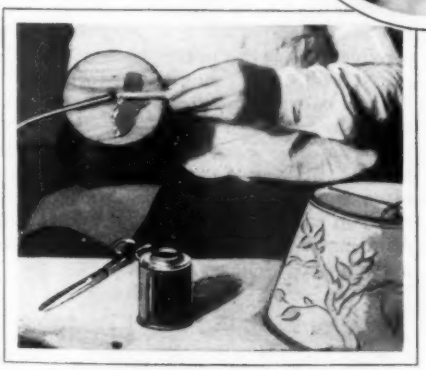
Below, Left, Gluing the Scrap Blocks Together to Form the Lamp Blank; Right, Glued-Up Blank Clamped in the Lathe

For most turnings you would go to a planing mill for the stock, but with this lamp only scrap pieces about the shop are necessary, for the block from which the lamp is turned is made up of a pile of blocks. In fact, if more than one kind of wood is used, so much the better. And the block thicknesses need not be the same. A very good effect can be obtained by making the base and spindle from a dark wood, such as mahogany or walnut, and the bowl from birch, maple, or some other wood that looks well finished "in the white." Or a couple of thin blocks of contrasting woods can be used in that part of the assembly which forms the bowl, giving the effect, when turned, of inlaid bands. If this is done, the bands are coated with thin shellac before the rest of the lamp is stained, so that the stain will not take on them. The lamp shown was made from walnut blocks of three thicknesses. The thickest, used for the base, was not glued up at the start but was turned separately. The re-

maining nine blocks (to give a total length of about 9 in.) were coated with glue on one side and stacked as shown. Then they were set between the centers in the shop lathe, pressed tightly together, and left over night for the glue to set. Notice that the blocks are not stacked regularly. This random assembling will give a result under a clear finish that is distinctive and lovely.

The exact design given need not be strictly followed; you can use any design you have in mind. Turn the piece first of all until every section is round, then proceed to develop the shape. Spend considerable time with coarse, then fine sandpaper until every unevenness and slight blemish is removed. The glue lines will be dark and of hair thinness. Remember that the strength of the piece is not so great when glued up in this way as when the grain runs lengthwise, so turn the small diameters with reasonable care and keep all





Top, Polishing the Lamp; Center, the Turned Base; Cutting Groove for Cord; Below, Gluing Felt to Base

dimensions above 1 in. Turn a tenon at the bottom, 1 in. long and 1 or 1¼ in. in diameter, and be sure the shoulder above it is square. This will insure a snug fit with the base. After the final sanding, go over the piece once more with fine steel wool or garnet paper, and finally with a handful of the shavings. This is really a polishing process. The piece is now ready for the walnut stain (if stain is to be used). After the stain has soaked in for a few moments, start the motor again and wipe the whole piece with a soft rag to remove any surplus stain. When the stain has dried overnight, you can go over the whole exterior with clear varnish. Then remove and hang up to dry by turning a screw-hook into the top.

Twenty-four hours later, again put the piece in the lathe and dress down with finest steel wool. Then add another clear-varnish coat and hang up to dry. This coat will dry in 12 hours or less. A third coat is not necessary, but will improve the finish. After the last finish has dried, again rub very lightly with fine steel wool or with pumice and oil to dull the surface. You may now wax it, if desired.

The base is a 6-in. block, 1¼ in. thick. The corners are sawed off, then it is screwed to the faceplate and turned down to the shape shown. The final maximum diameter should be 5¼ in. if the upper bowl is 6 in. in diameter. There is sufficient weight to make the lamp quite stable with this small base. Turn a hole nearly through the center for the tenon of the spindle, which should be a snug fit.

Finish the base in the same way as the

upright, using first the stain, then two or three coats of clear varnish, with a final light rubbing to dull the surface. Should you prefer the bright finish, you can omit the use of steel wool or pumice and oil. Another way of producing a fine polish is to rub with rottenstone and oil, on a felt pad, after the finish has been dulled with the pumice. Dip the pad in the oil and then in the rottenstone, and rub the dulled surface until the polish returns. Be sure that the varnish is hard before attempting to rub with anything, as otherwise the job will be ruined. As a rule, it is not safe to rub varnish until at least 48 hours has elapsed from its application; also one should be sure that varnish intended for rubbing is used, such as cabinet-finishing varnish. Varnishing is not essential, as a satisfactory finish can be built up with shellac by the same process. The writer used a buffing wheel on a flexible shaft, as shown in one of the photos, to lessen the labor of rubbing.

When you bore the upright, put a ⅜-in. bit or gimlet in the motor chuck and bore through halfway from each end. Be sure to keep the ends between centers to insure a smooth hole.

Get a brass flange with threaded nipple to take a standard socket for the top, and, centering this carefully, fasten with screws on top. Then pass the cord through and wire the socket before screwing it in place. Cut a groove with the power saw or chisel, leading from the center to the edge of the base and large enough to hold the cord and small staples with which it is fastened after the slack has been taken out. Now pour some glue on the bottom, rub out to the edges with your finger, put on a piece of green felt and trim off the edges.

A 50-watt lamp is about right. Get a shade and frame that will rest upon its top, as shown, and your lamp is complete. The shade shown came from the variety store and cost 25 cents.

Preventing Condensation in Gas Heaters

During the late fall and early spring months, when the furnace is shut down, many home owners use a radiant gas heater. When the burning is on such a large scale as in these heaters, the moisture resulting from it strikes the cool wall, condenses and sometimes damages the walls so that redecoration may become necessary. This trouble can be minimized by properly ventilating the heater. If the flue in the fireplace in which the heater is kept has been entirely closed to prevent the escape of heat, it should be partly opened and some form of canopy extended over the front of the gas heater about 6 in to catch the moisture-laden air and carry it out. A small opening in the flue does not carry away much of the heat. The opening should, of course, not be larger than necessary. Where it is not possible to install the heater in a fireplace, and some of the walls of the room are outside ones which are exposed to the weather and are therefore cooler than the room temperature, a vent should be provided above the heater, such as a partly raised sash or an opening cut in the wall A little care in this preliminary work will generally save an expensive decorating job later on. Failure to obtain the full amount of heat from such a heater is often due to the use of a rubber hose too small to carry a sufficient amount of gas. As a matter of safety a rubber-hose connection should never be used.

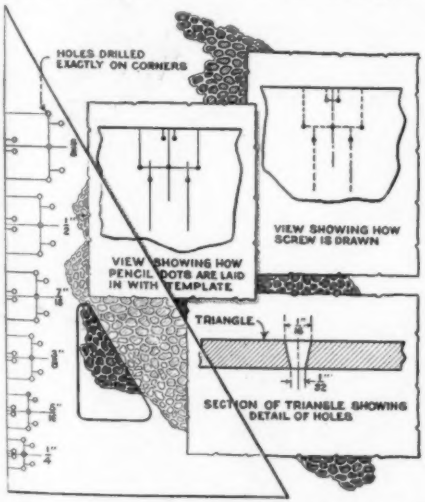
Waterproofing Old-Model Ford Cars

Ford cars of the older models usually have trouble with water getting into the coil box, which makes it impossible to start the car. The point where the water generally enters is between the dash and the metal cowl. The writer found a simple remedy that has proved effective in keeping water out. Loosen the bolts that

clamp the dash and the cowl together several turns and pry them apart. Tamp some oakum strips, with a screwdriver or other suitable tool, entirely around the dash. Insert quite a quantity of oakum, forcing it well into place below the top edge of the dash. Tighten the bolts again, which will compress the oakum still more. Go over the job and tamp down any stray strands and then apply thick shellac liberally with a small brush, letting it run down into the material. If this is done carefully, a permanent waterproof job will result.—Harold P. Strand, Malden, Massachusetts.

Template for Fillister-Head Screws

Tool designers will find the triangle illustrated of considerable utility for marking off fillister-head screws, as it eliminates the use of a scale and a consulting table for measuring and drawing screw heads on drawings. The sizes of various screws in common use are first carefully scribed on the edge of the triangle as shown. Small holes, as indicated in the detail, are then drilled to take the pencil point. The method of using the tool is obvious as well as the saving of

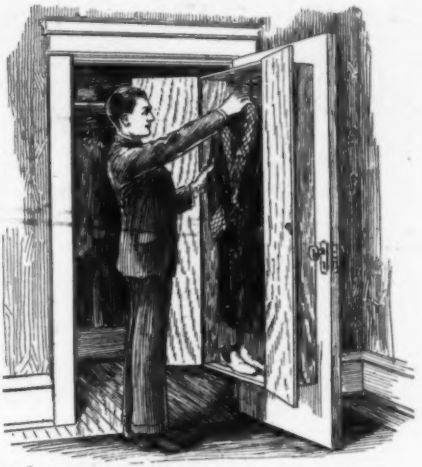

HOLES DRILLED EXACTLY ON CORNERS
VIEW SHOWING HOW SCREW IS DRAWN
VIEW SHOWING HOW PENCIL DOTS ARE LAID IN WITH TEMPLATE
TRIANGLE
SECTION OF TRIANGLE SHOWING DETAIL OF HOLES

Laying Off Fillister-Screw Heads on Triangle Saves the Draftsman's Time

time that can be effected with it.—Alfred Westrom, South Bend, Ind.

Wardrobe Attached to Closet Door

In apartments and small homes where space is limited, an excellent wardrobe



Wardrobe Attached to the Inside of Closet Doors Provides Additional Space

can be built onto the inside of one or more closet doors as shown in the drawing. It consists of a box of plywood, plaster board or even of corrugated cardboard. Although it may be made the full height of the door, 60 in. has been found a convenient height. The depth should be about 9 in. and the width must be less than that of the door so that the box will not interfere with the opening and closing. The shelf formed by the bottom of the box provides a place for shoes and slippers, and if desired, an extra shelf may be arranged at the top for hats.

Lens Shade for Beach Photography

Many photos, taken at beaches and other places where reflected light is intense, are failures because the photographer neglects the use of a lens shade. Such a shade can be made in a few moments from dull-finish black paper. Cut a narrow strip and make a cylinder to fit over the lens barrel, then pin or glue the overlapping ends together. If a more durable shade is desired, make it from light sheet metal painted dead-black to avoid reflections.—Wm. C. Vestal, Redlands, California.

How the Car Cushions Can Be Arranged to Form Comfortable Bed for Emergencies

Arranging Bed in Two-Door Sedan

Owners of a two-door Ford sedan can arrange the cushions and seats to form a comfortable bed. Detach both front seats by slipping off the rings and drawing out the hinge bolts which hold the legs. Raise and slide the back seat forward to unfasten it and remove the bolt and nut which holds the back cushion. Lift this cushion off the hooks that support it and then turn the back seat around so that the highest part of the cushion is in the rear. Place both front seats on one side with their backs against the side of the car. Then fit the back cushion in the remaining space, blocking it up to the level of the other cushions. In this way a bed 40 to 47 in. in width and 60 to 70 in. in length can be improvised. Sliding screens can be obtained to fit the side windows to provide ventilation without letting insects inside.—Dr. Paul W. Goldsbury, Warwick, Massachusetts.

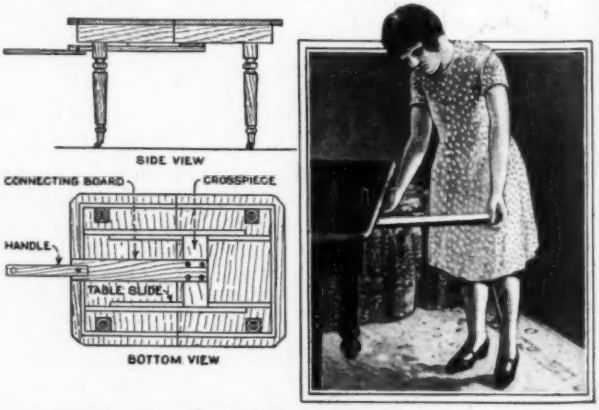
¶A squeaking door hinge should be lubricated with graphite and a drop of oil.

Durability of White Paint

Some tests of white paints for outdoor use undertaken at the bureau of standards show interesting results. The paints under test are white lead, lead-zinc and lithopone. Thus far, results have been obtained on six weeks of accelerated exposure, taking a set of panels out of the test every week. The white-lead paints fail by chalking off and by fine checking, and the lead and zinc paints by cracking, resulting in flaking or crumbling off of the paint coat; the lithopone paints fail by heavy chalking and checking, and soon disappear from the wood. White lead shows up best, lead-zinc next and lithopone a poor third. Lithopone paints fail in about three weeks, under the accelerated tests, and lead-zinc in about five weeks. The white-lead paints, after six weeks' exposure, have not reached as bad a condition as the lithopone paints have done at the end of three weeks.

Handle for the Extension Table

Usually it takes two persons to open an extension table for inserting the extra leaves, but it can easily be done single-handed by the following method: Screw a crosspiece to the sliding rails at one end of the table and to this a connecting board that reaches to the other end. A handle provided with a thumb hole is attached to the latter. The handle is held with one hand while the nearest end of the table is



Arm Attached to Extension Table Makes It Possible for One Person to Open or Close It Single-Handed

pulled or pushed, according to whether it is to be opened or closed. When not in use, the handle is swung out of the way beneath the table.—Alice Moore, Hamilton, Can.

Mortar for Brick Walks

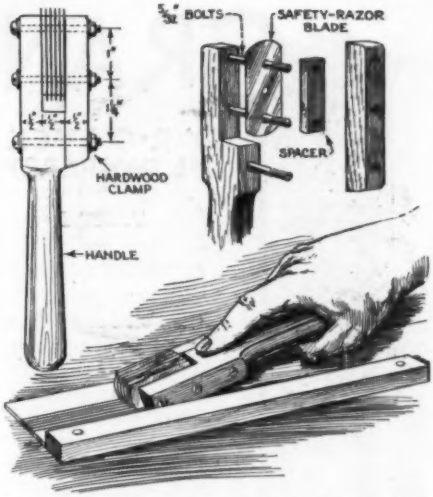
Front-entrance walks are often made of bricks for the sake of appearance, but if they are not well laid they will not be durable. The trouble is found mostly in the mortar, which often crumbles away after a winter or two, making repairs necessary. The mortar used for this purpose can be so made that it will not be affected by frost. To ½ bu. of unslaked lime add 1½ bu. of sharp sand, commonly known as "torpedo" sand. Then mix ½ lb. of alum with ½ pt. of linseed oil separately, and add this solution to the mortar. Use the mortar as hot as possible.—L. H. Georger, Buffalo, N. Y.

Gnarled Tree Roots for Garden Furniture

Attractive porch and garden furniture of the rustic type can be made from gnarled tree roots and branches, an example of which is shown in the photo. This odd chair was made of roots. The pieces are, of course, thoroughly cleaned, then cut and fitted with care in order to produce an attractive design. If a finish is desired, the surface may be sanded after the article is completely assembled, and then given a coat of shellac or varnish.—H. Rossiter Snyder, Guilford, Conn.

Tool for Cutting Balsa Strips

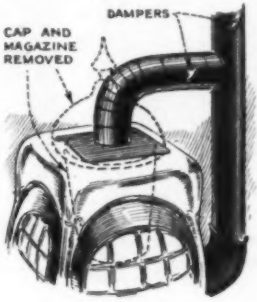
Balsa strips as small as 1/16 in. square can be cut with the tool shown in the illustration. It consists of a number of old razor blades and wooden spacers bolted in a hardwood holder. With this arrangement it is easy to remove the blades when dull, or to change the spacers for cutting strips of any desired width. If you have attempted to cut a straight strip of balsa by running a knife along the edge of a ruler, the convenience of this tool will be appreciated.

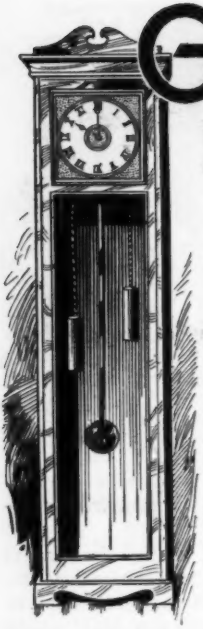


Handy Tool for Cutting Strips of Balsa Wood of Any Desired Width

Converting a Hard-Coal Stove into a Soft-Coal Burner

By making a few simple changes in a hard-coal stove, it can easily be converted into a soft-coal burner. Remove the cap, lid and coal magazine. Substitute a lid cut from galvanized sheet iron, using the original lid as a pattern. Cut a hole in the center to receive the end of a stovepipe nipple. After this is inserted, fit onto it an elbow and a second nipple containing a draft damper, connecting this nipple to a tee in the flue. After the pipes have been set and wired, the lid and pipe edges are carefully closed with stove cement.—Lydia MacGregor, Manistee, Michigan.





GRANDFATHER YOU CAN

BY R·O·BUCK and L.DAY PERRY

PART I

THERE is a special appeal to the home craftsman in the construction of a grandfather clock, for it combines utility with beauty to an unusual degree, plus the added advantage that it is never out of style. If a good movement is installed, the grandfather clock you build will serve your modern household and perhaps your children's for many years just as did the long-case clocks of old.

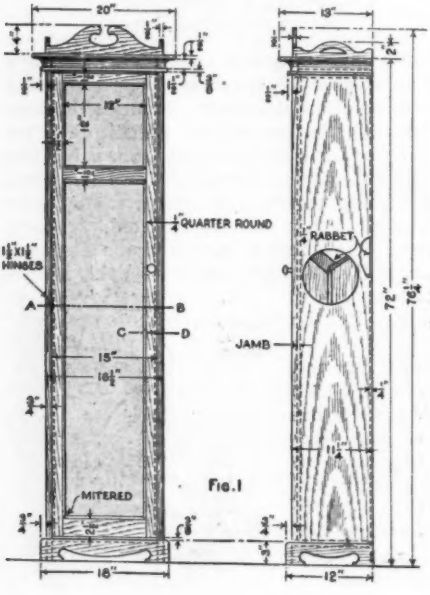


Fig. 1

Grandfather clocks fit well in the decorative scheme of bungalow, house or apartment. They may be designed to fit any room, regardless of ceiling height or size, and to harmonize with the surroundings. Of course, it would be impossible to describe all the types in the limited space allowed in an article; we are presenting, however, two typical designs which we believe are especially suitable for home construction. They are within the ability of anyone who has the patience to do an accurate job of fitting combined with a fair degree of skill with commonly used woodworking tools. The clock case described first is typical of a design much in vogue in the humbler homes in colonial days, while the second is a composite design of many periods. Both of the designs possess grace and beauty of line without ornate decoration.

The colonial case, as we shall call it for convenience, is built much in the form of a long box and most nearly resembles the old long-case clocks. As shown by the drawing Fig. 1, it has solid sides made of 12-in. boards, 1 in. thick. After the boards are planed and sanded they will be the approximate size specified in the drawing. The dimensions given in all the drawings are finished sizes.

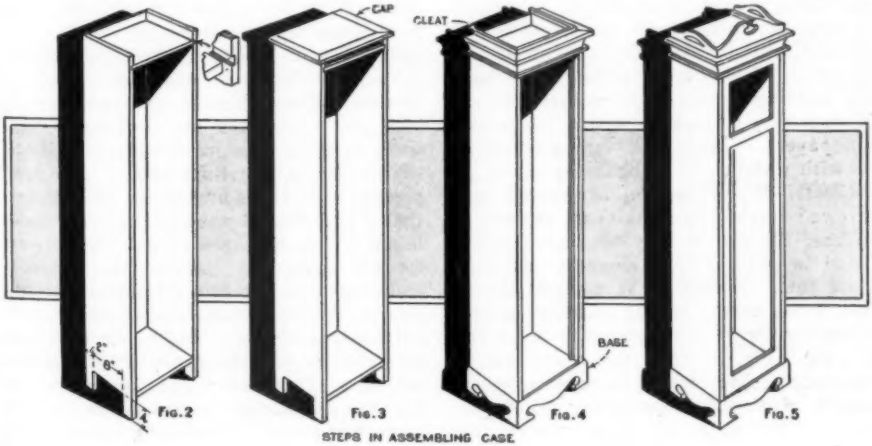
In building objects of this type, it is essential that an orderly procedure be followed so that each separate part will fit the assembly. Accurate measuring, and, what is equally important, working to measurement is necessary to secure tight joints and a square, well-made case. The progressive steps in the assembly are shown in Figs. 2 to 5, inclusive.

The first step should be the roughing out of all the principal pieces, that is, cutting them to approximate size. For the sidepieces, select two boards that have a pleasing grain, if a varnished finish is to be used, as the markings will be greatly in evidence. After squaring and planing

CLOCKS BUILD

the sides, measure off the spacing for the top and bottom pieces, and notch out the bottom as shown in Figs. 2 and 3. The purpose of this is to make a clear opening for the ornamental base mold that is fastened to the sides. This method is used in order that the sidepieces may extend to the floor, thus adding rigidity, an essential quality of a clock case. A ¼-in. rabbet to house the backing should also be cut into the back edges of the sidepieces. If you have no rabbeting plane or circular saw for cutting this rabbet, another method may be used for fastening the backing. Tack and glue two triangular strips, about ⅜ in. thick, on the inner face of each sidepiece, setting them back ¼ in. from the back edge. After the top and bottom are in place, similar strips should be fastened to them also. The backing of plywood is to be glued and tacked into place. The method for the first part of the assembly is very simple. The top and bottom pieces are nailed and glued into dados, as shown in Fig. 2, after which the back may be set in and fastened as just described.

The cap piece, which is to be ½ by 13 by 20 in., should be glued up in the manner shown in Fig. 3. First glue up or secure a board, ½ by 11 by 16 in., of any soft wood. Be sure that the piece is square and the edges true. To three edges of this, glue strips, as indicated in Fig. 3, of the same kind of stock as is to be used for the outside of the case. They should be ½ in. thick and 2 in. wide. The edges are formed after the strips have been glued, but the corners should be



STEPS IN ASSEMBLING CASE

mitered to avoid having end grain show on the finished surfaces. The outer edge of the molding is made half-round as shown in Fig. 7. Nails and glue are used to fasten the cap in place.

Fig. 4 shows the base pieces and fillet fastened in place. The formed base pieces are ¾ in. thick, quarter-round on the top edges. Figs. 10 and 12 are patterns for the front and side base pieces, half of each pattern being shown. Each square represents ½ in., so it will not be difficult to make full-size cardboard patterns of these pieces. After tracing the curves on the stock, the sawing is done with a coping or turning saw if a band saw is not available. The corners should be carefully mitered and glued when assembling them on the bottom of the frame. The fillet consists of three strips of the outside stock, ⅜ in. thick and ½ in. wide, with a half-round edge as shown. The corners are mitered and the pieces fastened with small brads and glue in a position just 1½ in. below the underside of the cap. Between cap and fillet a cove molding is used as shown in Fig. 7. This is a stock molding that can be purchased at most any mill in pine, and perhaps oak or gum, but is rather hard to find in mahogany. If you are unable to purchase the molding in the wood required, it will be necessary to make it with a gouge and sandpaper. This is not very difficult to do with walnut or mahogany.

Cleats, ¾ in. square, are glued and screwed to the top of the cap, as shown, so that the crown may be securely fastened in place. Care must be taken to place them accurately, as a slight deviation from center in the spacing of the formed crown pieces would be very noticeable. Fig. 5 shows the crown pieces and door in place, which completes the assembly of the clock except for the movement. The crown pieces are made from the half patterns given in Figs. 9 and 11, as previously described. The joints are mitered and the whole nailed and glued in place. Fig. 7 is a sectional view of the upper part of the assembled case.

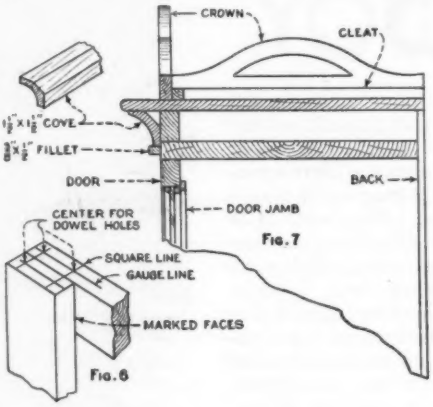
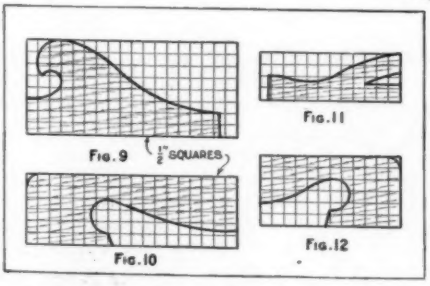


Fig. 6 Fig. 7

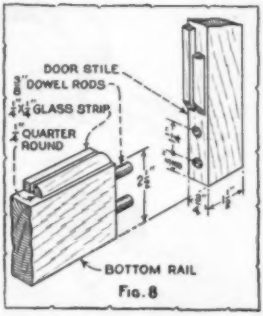
The construction of the door is perhaps the most difficult part of the whole job, for it must be straight and true and have good solid joints. A simple type of door construction has been chosen in order to avoid any complicated joinery. The door material, consisting of two stiles and three cross rails of the sizes given in the drawing, should first be cut to exact size. Holes for dowel rods are next located on the various pieces as follows: Lay the pieces on your bench in the position they are to occupy in the finished door. Mark the top face of each, also mark each joint with some distinguishing number. Turn the pieces so that the two marked faces are together, as shown by Fig.6, and mark the positions of your dowel holes with a sharp knife and a try-square. A marking-gauge line, run across these marks, will determine the location of the holes. The dowel holes must be drilled straight and true, and about 1¼ in. deep. If you are not sure of your ability to drill these holes true, a jig should be used. This may be one of the metal kind on the market, or a simple one that you can make will serve quite as well. This jig consists of a block of hardwood, the thickness of the door pieces, with cleats nailed on its sides so that it just fits the edge of the stock to be bored. Through this block, bore two straight, true holes of the size required, and spaced as shown in the drawing. This device insures a true set of holes with correct spacing and is well worth the trouble involved in making it. After all holes are bored, the door should be assembled with the dowel rods, to make sure that all joints fit snugly. Fig. 8 shows a detail of

the joints, which are to be clamped and glued. Care must be taken to keep the door flat and true in the clamps. If clamps are not available, a good job of gluing can be done by simply nailing cleats on your bench top and driving wedges between them and the door pieces, in order that necessary pressure may be obtained.

Strips to hold the glass in place are tacked and glued in place after the door is assembled and glued up. By using strips in this way the necessity of rabbeting for the glass is avoided. Figs. 8 and 13 show how these strips are to be fastened and used. The quarter-round is fastened in first, the glass strip being added only after the case is completed and the glass installed. The glass in front of the dial and that in the lower part of the door should be in separate pieces to avoid having too long and narrow a piece. You will have to make the ¼-in. quarter-round with a plane and sandpaper, as it is not stock material. Jambs for the door are made of ⅜ by ¾-in. material, and are tacked and glued in place as shown in the section AB, Fig. 13.

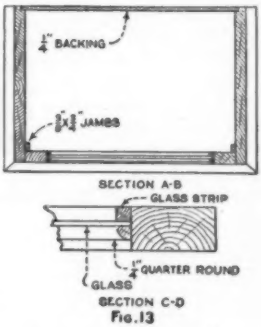


Hinges, a knob and bullet catches are all the hardware that is required for this case. Three 1½ by 1½-in. loose-pin butts will be satisfactory, although many cases have four hinges. Bullet catches, also called spring catches, are placed in the top and bottom edges of the door to keep it closed. A wood or brass knob, to harmonize with the hinges, will be satisfactory.



Grandfather clocks apparently were made out of practically all of the cabinet woods, the kind depending largely on the availability of the particular wood and the taste of the cabinetmaker. Mahogany and oak seem to have been the most favored woods, although walnut, rosewood, teak and ebony were often used, alone or in combinations, in some of the finer and more elaborate cases, where a great deal of carving and other forms of ornamentation were added. Oak seems to have been used for most of the simpler and more rugged types in the early colonial days.

There is no standard height for grandfather clocks even to this day, though the size of the dial and other features have been standardized by several of the larger manufacturers. The size of the dial regulates to some extent the size of the case, however. The length of the case must also be great enough so that the weights will have the required distance of travel. The designs given herewith are suitable for rooms of average modern height.



(To Be Continued)

Interchangeable Cover Spout for Pouring Paint from Small Cans

Cover Spout for Pouring Paint from Small Cans

In the laboratory of a paint and varnish-manufacturing concern, where it was necessary to pour small portions of paint from numerous small cans, a cover spout was found useful to prevent paint from running over the edge and smearing the cans. The spout was made of light sheet metal, cut and bent to the shape shown in the details, and soldered to a can cover in which a hole was made. A handle is also provided on the cover so that it can be removed without the aid of a tool. All the cans were of the same size, and one cover spout was therefore interchangeable.—E. Perry, Oakland, California.

How to Destroy Insects on House Plants

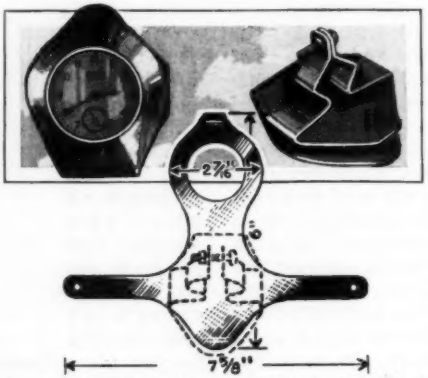
Growing plants are frequently not desired in the home owing to their tendency of collecting insects. It is a simple matter, however, to get rid of them periodically. Buy some yellow phosphorus and put it on a tin-can cover. Ignite it and place a wash boiler over both plant and burning phosphorus. The fumes will kill the insects in a few minutes.

Flexible and Durable Crack Filler

I experimented with all kinds of commercial crack fillers for closing a weather-exposed opening where the wood was subject to intermittent swelling and shrinking, and found that the filler would always crack and loosen. However, a good substitute for the purpose, which I found entirely satisfactory, is wadding made of paint-saturated rags.—Dexter W. Allis, Everett, Mass.

Watch Holder for the Auto

Fitted in the holder shown in the photo, a cheap watch can be used as an auto clock. It is made of No. 18 gauge sheet copper, cut and bent as indicated for attachment to the steering wheel, which is a convenient location. Portions bent to form a clamp and fitted with a screw and nut hold it in place. It may be polished and lacquered with transparent metal lacquer or painted black. The watch is slipped between the front and back sides, which are compressed just sufficiently to hold it firmly in position. The dimensions given in the detail can, of course, be varied. A good feature of this holder is that the watch can be removed and carried in the pocket when the driver leaves the car, so that it cannot be stolen.—Dick Hutchinson, Denver, Colo.



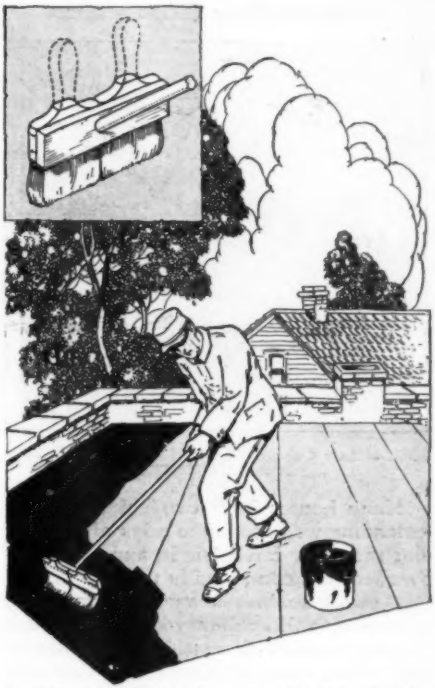
Convenient Watch Holder for the Auto Steering Wheel Is Made of Sheet Copper

Emergency Repair for a Rifle Sight

Just when I needed my rifle most, I found that the bead had broken off the front sight, and not having time to order a new one, I made a bead which has proved satisfactory in every respect. The broken sight was removed and the edge filed smooth. The top was then slotted with a sharp chisel and the sides turned out to form a Y-shaped slit. In the groove thus formed a piece of brass wire, slightly larger in diameter than the required bead, was soldered. The surplus ends of the wire and the solder were removed, and the bead ends polished. To check the height of the sight, fasten the gun securely and set up a target some known distance away. Fire the gun and adjust the rear sight until the sights target properly. The brass bead proved to be better than the one it replaced, as it does not rust and will take a polish.—C. F. Heizer, Falfurrias, Tex.

Hinged Screen on Closet Door Provides Dressing Room

Where sleeping rooms are small and closet space is limited, one may enjoy the convenience of privacy by hinging a screen to the inside of the closet door as shown in the drawing. The screen may be made of a wooden frame, covered with fabric such as burlap, or it may be a piece of plywood or plasterboard. It should, of course, be smaller than the closet door to prevent interfering with opening and closing. When not in use, it is hooked to the door so that it will not swing out every time the latter is opened. If desired, another hook may be provided to hold the screen in the open position.



Roof Brush Improvised from Two Old Paint Brushes Attached to Suitable Handle

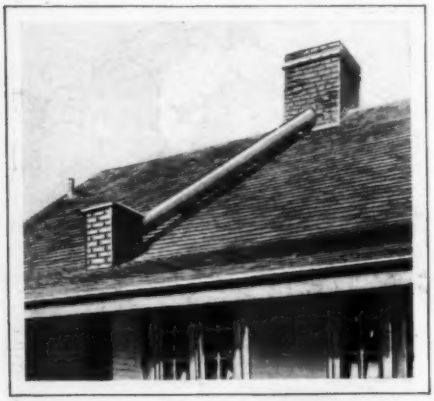
Improvised Roof Brush

Two old paint brushes, about 4 in. in width, nailed to a 1 by 2-in. crosspiece to which a handle is attached, make a good roof brush. The brush handles may be cut off as indicated in the upper detail. The hole in the crosspiece for the handle is drilled at an angle so that the free end will be raised about 3 ft. above the surface of the roof when the brushes stand vertically. This will make for easy manipulation.—Jesse L. Blickenstaff, North Manchester, Ind.

Attractive Emblem Belt for Small Boys

A belt in which small boys will take considerable pride can be made by attaching to it emblems taken from old automobile radiators, which can be obtained for a few cents from a junk dealer. To fasten them on securely, drill small holes in each one and rivet them to the belt.—E. T. Gunderson, Jr., Humboldt, Iowa.

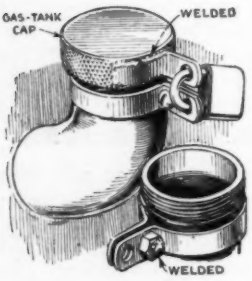
To Make a Low Chimney Draw



Draft of Low Chimney Can Be Increased by Connecting It to the Main Chimney

Many houses have two chimneys, one extending well above the ridge of the roof but the other far below it, and trouble is frequently encountered in the lower chimney owing to insufficient draft. Adding a portion to this chimney is expensive and usually detracts from the appearance of the house. An effective method of providing more draft in the smaller chimney is to run a 9-in. iron pipe up the slope of the roof to the ridge chimney. The open top of the former is sealed to divert the smoke through the pipe, which is supported by bricks laid on the roof, providing an air space and thus eliminating any fire hazard.

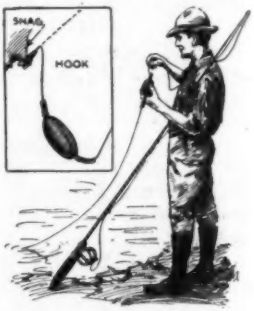
Gasoline Theft from Autos Prevented by Locking Cap



As it is an easy matter to siphon gasoline from auto tanks, many motorists frequently find their tanks empty. To prevent such annoyance the gas-tank cap can be locked on the filling spout, as shown in the drawing. Get a length of flat iron or steel, about ⅛ in. thick and ½ in. wide. A short piece is cut off and bent to fit the cap, to which it is welded, and a hole is drilled through the projecting end. The rest of the strip is bent around the filling spout, just below the top, both ends being allowed to project. A small stovebolt is used to draw the ring up snugly around the spout, after which the nut is welded on so that it cannot be removed without a hacksaw. A hole is drilled in line with the hole on the piece welded to the cap, so that a small padlock can be snapped on as indicated.—G. A. Luers, Washington, District of Columbia.

Lead Sinker Salvages Snagged Fishing Tackle

To aid in salvaging valuable fishing lures, one fisherman uses a heavy lead sinker, which he slips over the line and allows to sink against the tackle, causing the latter to be dislodged. The sinker is made by melting a quantity of lead and pouring it into a plaster-of-paris mold, through the center of which a small coil spring is arranged, the spring being long enough to project about 1½ or 2 in. at each end. The sinker thus can be slipped on the line without removing the latter from the pole. The sinker is then whipped down to the snag where it usually releases the hook, after which the line is reeled in and the sinker removed.—G. E. Hendrickson, Argyle, Wis.



Putty for Glazing Hotbed Frames

Many amateur craftsmen, who pride themselves on the work they do in building hotbeds, wonder why the putty holding the panes does not stay in place. Probably they have used ordinary putty. A special mixture must be made to stand the expansion and contraction, which oc-

curs in a hotbed frame; it must be elastic. Such a putty can be made by adding one part of beef tallow to nine parts of raw linseed oil, with enough white lead to produce a suitable consistency. This mixture will never become hard, but will allow the necessary expansion and contraction without losing its hold.

Mirror Makes Rattrap Effective

In our office, where rats were occasionally seen, an ordinary trap was tried with poor results, no matter what kind of bait we used. The following trick was found effective, however: A small mirror was set against the wall so that a rat near the trap would see its image. Competition between the rat and its image in getting the bait may have been the reason for the success of this method, as rats were caught every day.—Walter J. Stefaniak, Buffalo, N. Y.

Stone Path Adds Beauty to Lawn

The beauty of a flagstone path in a lawn or garden depends largely upon the arrangement of the stones, and this should be carefully studied out before they are permanently set. Place them loosely on the ground so that they can be moved about until a satisfactory effect is obtained. Then dig holes that will take the lower half of each stone, or raise them with gravel if it is desired to make the path higher than the adjacent ground, which is sometimes advisable in order to drain the path properly.—H. Rossiter Snyder, Guilford, Conn.

Flagstones Laid Out on the Lawn to Get Good Arrangement before Setting Them Permanently

Camera Support on Auto Fender

Camera Support Set on Auto Fender for Taking Time Exposures

Taking time exposures on the road requires a level support, which is usually not found on an auto. It is an easy matter to provide one, however. Take a tin saucer, cover it with heavy cloth and tack it to a small square piece of wood, preferably plywood. The inverted saucer is set snugly on the fender so that the board on which the camera is set is level. This enables the tourist to take a picture in any direction with no trouble and a minimum loss of time.—Harold E. Benson, Denver, Colo.

Staining Wicker Work

Wicker work is frequently stained by means of oil or alcohol stains but they are unsatisfactory because the stain wears off after a few months, leaving objectionable light-colored spots. It is much better to use a varnish made from soft gum, such as sandarac, dissolved in methylated spirits. To this may be added any aniline dye in the proportion of three per cent of the varnish.

¶A cloth used for straining can be held on a pail rim with clothespins.

Old Barn Makes a Cozy Clubroom

Transforming the Old Barn into a Cozy Studio or Clubroom

There are many old barns and outbuildings which can be made into useful shops, studios or clubrooms without going to a great deal of work and expense. Rough-textured wallboard is nailed to the studs of the walls and partitions. The seams are covered with 4-in. battens and these are stained with dark-brown walnut stain to obtain the effect of a half-timbered English cottage. It is an easy matter to rig up an old wagon wheel to serve as a chandelier, as shown in the photo, which may be suspended from a beam by chains. —H. Rossiter Snyder, Guilford, Conn.

How to Repaint Venetian Blinds

Where Venetian blinds are used, it is necessary to understand the method of handling them when they require repainting. The tapes should be removed and the blinds pulled apart. Each slat should be thoroughly cleaned with soap and water, rinsed and dried, after which it is given a coat of paint to harmonize with the color scheme of the room. When all the slats have had two or three coats of paint, and are dry, they should receive a coat of clear spar varnish. If the old paint is rough or blistered, scrape it down or use paint and varnish remover. The latter must, however, be completely taken off and neutralized before applying paint, which can be done by first washing thoroughly and then using oxalic acid. Use only the best grade of paint. It is a good idea to drive a small brad into the end of each slat so that it can be handled without touching the painted surfaces. Tie a string to the brad to facilitate hanging the slats up to dry. When dry, the brads are removed and the slats restrung. Cord for this purpose can be obtained from a shade and drapery dealer. If you cannot get the desired color of cord, get white cord and dye it with cold-water dye, which can be had at any drug or notion store. Always get the best grade of cord, as a cheap quality will stretch and cause the slats to sag or pull apart.

Safe Cleaner for Delicate Fabrics

A non-inflammable cleaner can be made by mixing kerosene, 10 oz., carbon tetrachloride (commercial), 30 oz., and oil of citronella, 20 drachms. If a strong odor is perceptible in the carbon tetrachloride, shake with some powdered charcoal, and filter. The color should be as clear as water. This mixture will clean very dainty and delicate fabrics; it cleans all kinds of jewelry, removes tarnish and oily deposits from tableware, rust from tools, verdigris from copper, etc.

Brush for Cleaning Bolt Holes in Bearing Caps

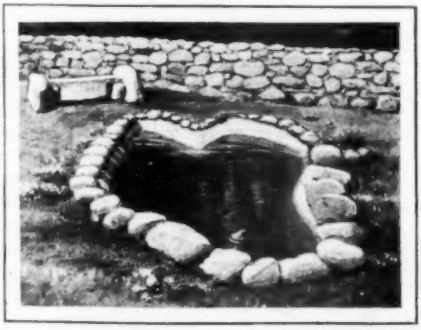
When filing bearing caps, use a small round bristle brush, as shown in the illustration, to clean the filings out of the bolt holes. Brushes suitable for this purpose are those designed for cleaning coffee percolators, and cost only a few cents. One push of the brush through the bolt hole of the bearing cap is sufficient to remove the filings.

Shellac for Waterproofing Matches

The method used for waterproofing wood patterns against the effects of damp molding sand suggests a similar treatment for matches, which will be appreciated by many hunters, campers and fishermen. Just dissolve some shellac in denatured alcohol until it becomes of the consistency of thin cream. Dip the matches in it and then let them dry, which will only take a few minutes. Many years of use have proved matches prepared in this way to be entirely satisfactory.

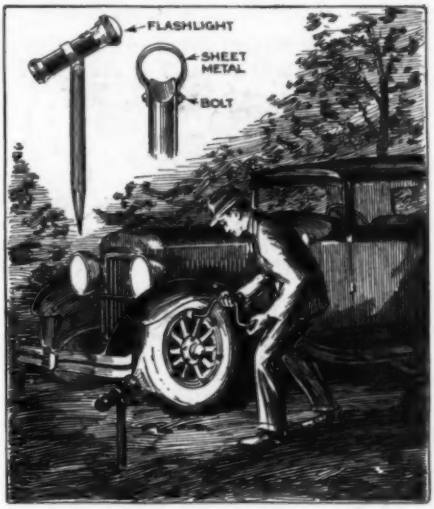
Heart-Shaped Garden Pool

It is almost as easy to make a garden pool of irregular shape as one of the conventional round, square or rectangular design. Lay it out by dusting white powder on the ground and then dig the inclosed area to the desired depth, leaving the banks sloping. The concrete must be stiffer than usual as it is not poured in a form, the consistency of putty being satisfactory for the sides. The bottom may be formed of concrete which has more water in it, and should be about 3 or 4 in. thick. When the concrete begins to set, it can be troweled smooth. The



Garden Pool of Heart Shape Is Out of the Ordinary and Easy to Make

proportions for the concrete should be, for the sides, 1 part of cement and 3 parts of sand, and, for the bottom 1 part of cement, 2 parts of sand and 3 parts of pebbles. The concrete should be thoroughly mixed before any water is added. Laying flagstones along the edge of the pool will add to its attractiveness.



Short Stick and Clamp Make a Handy Holder for the Motorist's Flashlight

Flashlight Holder for Changing Tires

Motorists will find the flashlight holder illustrated convenient for changing tires. Driven into the ground in a suitable position, the light can be adjusted to illuminate any part. It consists of a length of broomstick, pointed at one end and provided with a sheet-metal clamp at the other, the clamp being held with a screw and nut. The clamp must fit the flashlight to hold the barrel firmly without restricting its movement entirely.

Homemade Trays for Photography

Amateur photographers who use large-size trays only occasionally, do not always feel justified in purchasing manufactured trays of enamel ware, glass or hard rubber. Cheap homemade trays can be made as follows: Get a shallow sheet-metal baking pan of the desired size, or make a tray of light wood. Glue ordinary white oilcloth to the inside to make it waterproof, cutting it so that there will be some surplus material to be brought over the edges. After the glue has dried, apply three coats of acid and alkali-resisting bathtub enamel, allowing each coat to dry before applying the next.—Wm. C. Vestal, Redlands, Calif.

Cord Holds Movie Camera Steady

A most important detail in operating a movie camera is to hold it steady. In

Stout Cord Looped around Foot and Camera Helps to Hold It Steady

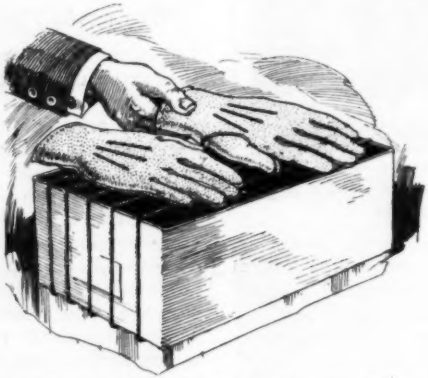
many cases, however, it is inconvenient to carry a tripod along and, unless a suitable rest can be found when taking the picture, it becomes quite a problem to hold the camera steady. I overcame this trouble by using a very simple method: I got a length of stout cord and looped one end around my foot and the other around the camera as shown. With a slight upward pressure on the camera, I kept the cord taut while taking the picture. You will be surprised to find how steady the camera can be held. A heavy rubber band tied between the camera and the cord will often add to the smoothness of "follow shots," as it prevents jerky movements.—H. Tappenbeck, Hollywood, Calif.

Methods of Cleaning Pewter

Some fanciers of pewter claim that the best method of cleaning it is by washing in water and pure soap, and then rubbing to a dull finish. Such treatment is all right for pewter that is regularly cared for, but if it is covered with grime and scale, the accumulation may be removed by means of a weak solution of hydrochloric acid, after which the article is immediately washed in pure water, care being taken not to leave the acid solution on long enough to eat holes in the metal. Soaking in kerosene is another method which is followed by rubbing to a finish. Then comes rubbing with a mild abrasive such as brick dust and diluted acid or even with a good metal polish. One collector never allows anything to touch his pewter pieces except castile-soap suds, followed by rinsing, hours of patient polishing by hand and a final rubbing with clean chamois skin. This, he claims, gives that quiet luster which properly belongs to old pewter.

How to Dry Out Damp Gloves

It is poor practice to lay damp gloves on a radiator or other warm metal surface to dry out, as it is likely to harden them. A better method is shown in the drawing. Take an old cardboard shoe box, cut the bottom out and wrap some heavy twine around it as indicated. Lay the damp gloves on the upper grate thus provided and set the box on a radiator or stove. The continual circulation of warm air will dry the gloves without doing them any harm.—Frank W. Bentley, Jr., Missouri Valley, Iowa.



Old Shoe Box Wrapped with Cord Makes Holder for Drying Damp Gloves

You Can Make This Shaper

By W. CLYDE LAMMEY

MANY individual home workers have been somewhat disappointed in the final results of their effort when making some piece of home furnishing. It is very difficult to get away from a certain amateurish look in the finished work. Its appearance lacks the completeness of the commercial product, even with careful designing. In short, there is one thing lacking—the finishing touch of the shaper. To most home mechanics, however, the cost of the commercial shaper is prohibitive and, besides, few of these machines are suitable for use in the ordinary individual shop.

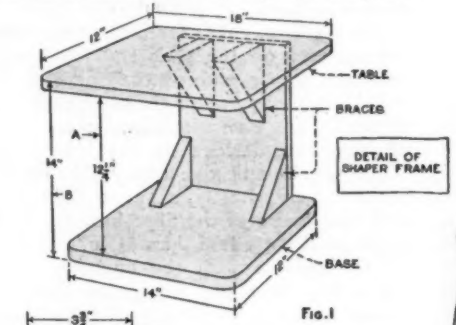
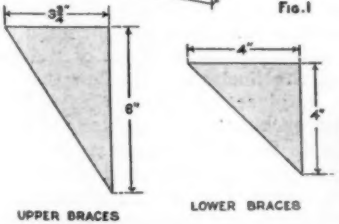
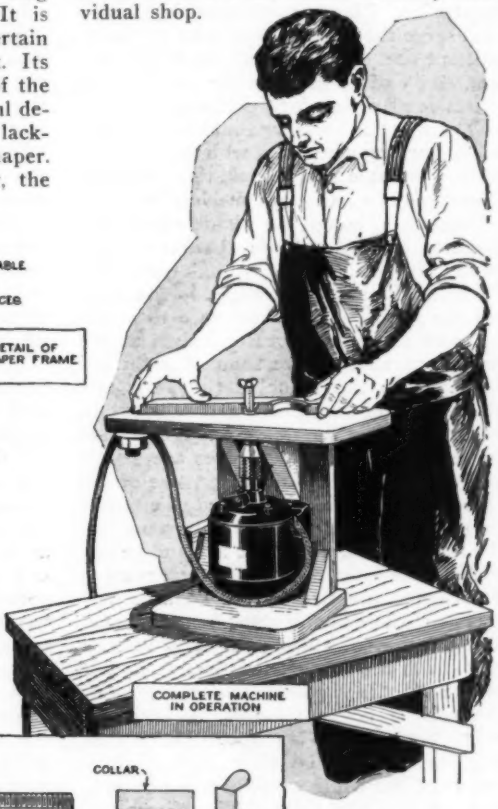


Fig. 1





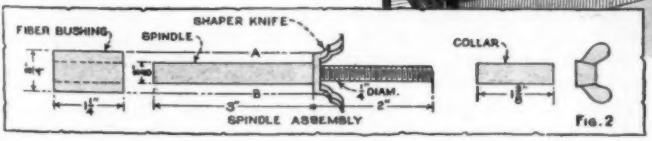


Fig. 2

The simple contrivance shown in the illustrations is capable of turning out a variety of first-class shaping on both straight and irregular work. The spindle is adjustable for any thickness of stock from ⅜ to 13/16 in., and even stock ⅞ in. thick can be molded by careful adjustment of the spindle. This range will cover the average of the work required by the individual user.

For best work, the motor should have a load speed of 3,600 r.p.m., run on ball bearings, and be of at least ¼ hp. Most electrical shops can furnish a secondhand motor to these specifications for a nominal sum. The motor must be able to run vertically.

A geared chuck of ½-in. capacity to fit the motor shaft is the most desirable, but expensive. There are cheaper chucks that will serve the purpose very well for intermittent use. Be sure that the chuck purchased is of ½-in. capacity and has an effective provision for tightening the jaws.

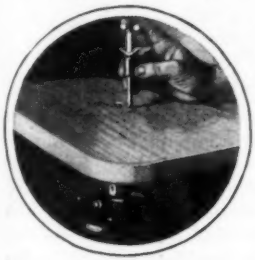
There are at least two makers of small woodworking machinery who make shaper knives suitable for use on this machine. These may be had in a considerable range of design. Though the single-edged cutter may be used, a knife of what is commonly known as the "wing" type with three or four cutting edges is the best. As the individual will not care to invest in more than two or three knives at the most, one should give some thought beforehand to the shape of the knife and the design of the molding it will cut in order to obtain its greatest range of usefulness. Sizes of wing knives are generally taken as outside diameter, size of the spindle hole and diameter at the lower cutting edge. This last is important and the knife should always be at hand before making the spindle. By this dimension is determined the size of the collar which acts as a guide to the stock being formed. The relation of these two parts will be seen from the two dotted lines A and B in the spindle sketch. The diameter of the spindle collar (in this instance the collar acts also as an upper bearing or bushing) should be only very slightly less than the width across from one cutting edge to the other. This dimension on the knife shown is 13/16 in., and the collar measures ¾ in., giving a clearance to the cutting edge of 1/32 in., which is sufficient.

Make the spindle before constructing the frame. As material, get a ⅜ by 6-in. bolt, or piece of ⅜-in. steel rod, a ¼-in. wingnut, a piece of round fiber rod, 2 in. long and ¾ in. diameter, a small piece of ¼-in.-thick flat fiber and a 2-in. length of aluminum tubing with an inside diameter of ¼ in. It is advisable also to get a ⅜-in. shaft collar with headless setscrew. Cut a 1¼-in. length from the fiber rod, mark the centers on both ends and bore a ⅜-in. hole clear through, boring from each end to center the hole. Smooth and square up the ends of the bushing thus made. When assembling in the frame, it may be necessary to cut the bushing shorter to allow the knife to work in the thinnest stock, but at first leave it this length. Turn or grind 2 in. of the bolt or rod down to the diameter of the cutter hole (in this case ¼ in.) and be sure to get the shoulder square. Rethread the end to fit the wingnut. The size of this end, of course, depends on the cutter hole, and the same applies to the wingnut and aluminum-tube sizes.

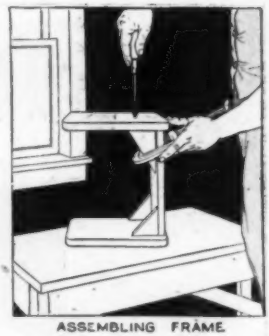
Cut a 1⅜-in. collar from the aluminum tubing, true off the ends and try for fit over the upper end of the spindle. It should fit easily. Run the threads down about 1¼ in. with a standard die. True off any irregularities on the lower end of the spindle and give a very light grinding all over. Lastly, make a light saw kerf lengthwise of the fiber bushing, to a depth of slightly less than ⅛ in. Assemble the spindle with the bushing, knife and collar in place, tightening the nut to seat the knife accurately. Set the bushing against the knife and bring up the shaft collar to within ¼ in. of the lower end of the bushing. Tighten the shaft collar in place. Slide this assembly in the motor chuck and tighten, with the spindle as far in the chuck as it will go. Measure from the lower end of the motor to the lower edge of the shaper knife. Deduct from this the exact thickness of the stock to be used for the table, plus ⅛ in., to obtain accurately the dimension A in the frame drawing. The ¼-in. space between shaft collar and bushing allows for the thickness of the fiber plate and at the same time permits the spindle bush-

ing to project ⅛ in. above the surface of the table to act as a guide on ⅜-in. stock. Dimension A is likely to vary, and should be determined for the motor in hand. Vertical adjustment of the spindle is made in the chuck, and for this reason we must be sure of sufficient projection of the spindle below the collar so that the chuck will hold firmly.

Make the table and frame from 13/16-in. sound, straight gumwood stock to approximately the dimensions given. Plane and sand the top of the table to a smooth, true surface and be sure that the ends of the upright are cut square before joining. Saw the four braces to approximately the sizes shown from 2-in. hardwood. The 3¾-in. dimension on the upper braces should be altered if necessary to bring the point of the brace slightly beyond the center of the spindle. Assemble the frame with screws and glue, for it must be rigid, and must not spring.



Locate the hole for the spindle bushing by bolting the motor to its base, being careful to get it alined with the frame. Place a small drill in the chuck, then slide the chuck forward on the shaft until the drill touches the wood. Mark this point and remove the motor. Transfer the location of the mark accurately to the table top. Bore the hole for the fiber bushing with a small expansive bit, first testing the setting on a piece of waste until the bushing is a light fit. In boring, be careful that the lower edge of the hole is not splintered. Make a vertical cut with a sharp knife in one side of the hole, making the cut about ⅛ in. deep and about halfway down from the top. Cut out a very small square of heavy tin, about ¼ by ⅜-in. in size, and drive this in edgewise into the knife cut. Sink the tin in the wood until less than ⅛ in. projects out into the hole. Bolt the motor back in place, assemble the spindle with the knife in position and slide the spindle in place through the hole, having the saw kerf on the fiber bushing engage the piece of tin driven in the knife cut. This piece acts as a key to prevent the bushing turning with the spindle. Tighten the chuck and turn the assembly by hand to test the running of the spindle. Make sure before bolting the motor tight that the spindle does not bind. It should run easily and without friction.

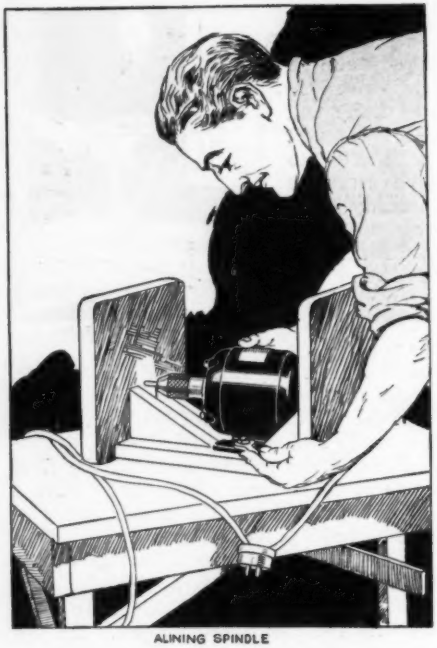


ASSEMBLING FRAME

Remove the spindle and cut the fiber plate to fit between the braces. Bore a ⅜-in. hole through the center and two smaller holes at the ends for screws. Place this in position on the underside of the table, slide the spindle through and slip the shaft collar over the end. Slide the spindle into the chuck and tighten. Set the plate so that the spindle turns freely as before and fasten it in place with small screws. Slide the shaft collar against the plate and tighten the setscrew. The shaft collar prevents the spindle from loosening in the chuck and slipping upward. To make a suitable cut on ⅜-in. stock it may be necessary to cut off a portion of the fiber bushing. Tap the bushing to the lowest position and measure the length of the projection above the table. As a rule, a projection of ⅛ in. above the table will make a cut on stock of this thickness. Should the bushing project more than this when in the lowest position, the excess may be cut off and the end trued up.

Set the knife to the desired thickness of stock; tighten chuck and be sure that the motor bolts are tight. Wire a 5-amp. two-pole switch in the

MOULDING EDGE OF BOARD



ALINING SPINDLE

motor line, fastening it to the lower side of the table, and the machine is ready to run.

If the edge is to be molded on a hard close-grained wood such as maple, it is better to make the cut in two separate operations. For the first, set the knife so that one-half of the cutting edge will run in the wood. Run this cut the length of the stock, then lower the knife for the second and finishing cut. This will cause less strain on the spindle assembly and, most important of all, we shall have as a result much smoother and cleaner work. The knife will cut to the full depth in any curve the radius of which is not less than that of the fiber bushing which acts as the guide. Keep the spindle well oiled, but be careful not to get oil in the chuck.

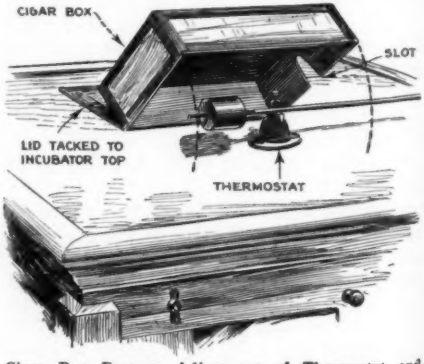
Lastly, it may be well to remind the worker who chances to be unfamiliar with it, that the shaper is a dangerous machine and must always be used as such. One should remember that the cutting edges of the knife are very sharp; that they are running in an exposed position and at a speed of 3,600 r.p.m. A slip might mean a serious accident.

Hardening Hacksaw Blade to Cut Tool Steel

Ordinary hacksaw blades are not intended for very hard steel, and if it is desired to cut such steel, the blade should be hardened. In doing this the blades would warp when brought to a cherry-red, but by experimenting, I find that if a blade is bound on an old flat file and both heated together, the blade will be kept straight and the file will retain the heat while preparing to dip it. The temper of the blade end should be drawn to prevent breaking. For extremely hard temper, heat to a cherry-red and give the blade a mercury bath, but guard against inhaling the fumes, as they are poisonous. Saws or drills hardened in mercury will readily cut glass if moistened with turpentine. In using a hard blade do not press too hard, and run it slowly.—Dr. W. H. Albright, Bellevue, Ohio.

Cigar Box Protects Adjustment of Incubator Thermostat

After losing a quantity of hatching eggs because the adjustment on the incubator thermostat had been dislodged by a rat or mouse, a poultryman used an ordinary cigar box to prevent a repetition of the trouble. A notch was cut in one end of the box to allow the damper arm unrestricted movement, and the box was then placed in an inverted position over the thermostat adjustment and damper arm, as shown, the lid of the cigar box being tacked to the top of the incubator, so that the box could be raised but not dislodged.



Cigar Box Protects Adjustment of Thermostat and Damper Arm on Incubator

Two Useful Greenhouse Ideas

Two highly useful features that will be appreciated by greenhouse owners are shown in the photos. To shield the greenhouse against the entrance of mice, rats, and insects, such as moths and butterflies, which may cause considerable damage

Above, Vermin-Proofing the Greenhouse with Screen without Interfering with the Window-Raising Arms; Below, Non-Slipping Platform for Use When Replacing Window Panes

to plants and flowers under cultivation, the side windows are screened. For this purpose galvanized screen of ½-in. mesh has been found satisfactory. Ordinarily the task of screening is quite difficult because the window arms are in the way, but the difficulty can be readily overcome by attaching a slotted piece of heavy galvanized sheet iron to both screen and window frame as shown. Small screws, nuts and washers are used for attaching the plate to the screen. Machine screws are similarly used to attach the plate to a metal window frame, the hole in the frame being tapped to receive the screw. Ordinary wood screws are used if the window frame is of wood. The second feature is the roof platform shown in the lower details, which is of use when replacing broken panes. It is made of 2-in. stock, the top piece being 12 in. wide and about 6 ft. long, while the sidepiece, which is spiked onto the underside of the top as indicated, varies in width according to the pitch of the roof. The top must be perfectly horizontal when the platform is set across the rafters. Pieces of an old bucksaw blade are drilled and attached with wood screws to the sidepieces so that the teeth project beyond the lower edge and bite into the rafters, thus preventing the platform from slipping.

Automobile Springs Lubricated with Blowtorch

A blowtorch can be used to advantage for oiling parts on the automobile which are ordinarily inaccessible. The torch is filled with penetrating oil or a half-and-half mixture of light oil and kerosene. The stream is directed onto the springs, brake connections, between fenders and the body, etc., and the work can be done without crawling underneath the car.—C. E. Packer, Chicago.

Unit Heater for Garage or Workshop

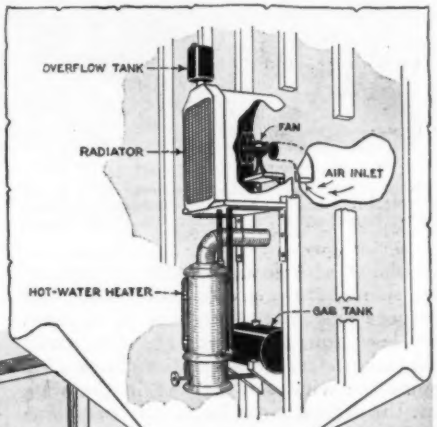
By KENNETH B. MURRAY

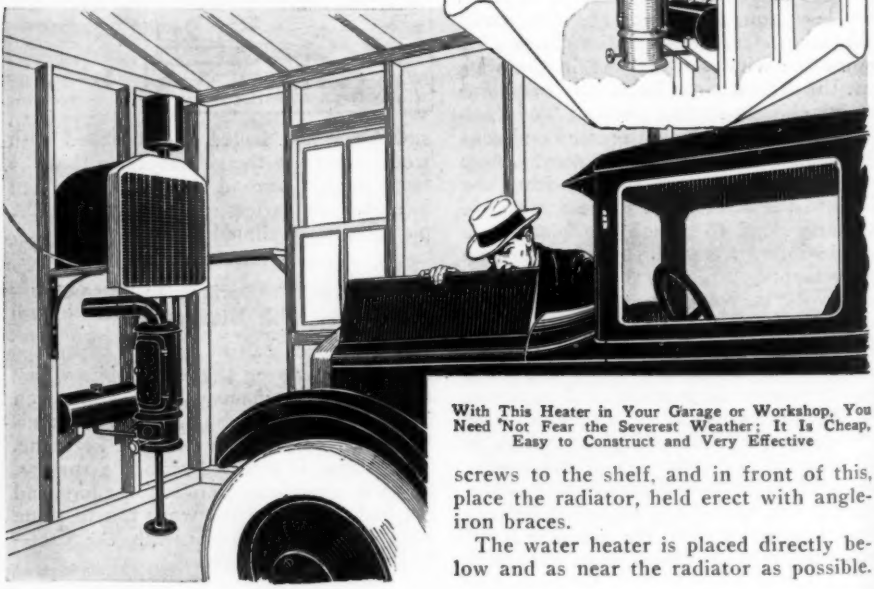
HEAT, and plenty of it, is wanted when the wind whistles through every crack in your garage or shop. A stove must be tended frequently; other methods are expensive. The heater shown here will operate continuously for $2 or less a week, day and night; it costs very little to construct, as most of the materials are already at hand or can be picked up for a small sum, and with the flame turned very low, even a large space is warmed hot as toast at a constant temperature day in and day out. The essential materials are: A gas water-heating coil, a gasoline camp stove, an electric fan and an old automobile radiator.

As the pictures show, the gasoline stove is used to heat the water-heating coil. The hot water circulates through the radiator, and an electric fan in the rear forces a continuous blast of hot air into the room. More than that, the air is fresh and provides ventilation, which is important while working on your car in the garage. In the town where the heater was first constructed, it was used to heat a small restaurant with wind exposure on all sides. So efficient and inexpensive to operate was it, that eleven other outfits were constructed by private parties.

First select a place for the heater, preferably in a corner, then, 5 ft. from the floor, fasten with steel braces a wood shelf that is as large as the radiator is wide. Cut a 3-in. hole in the wall and, on the outside of the room or building, fasten an elbow to serve as a ventilating pipe. A rainwater-pipe elbow answers the purpose, which is to allow air but not rain to enter. In front of the hole, install the electric fan, fastening it with screws to the shelf, and in front of this, place the radiator, held erect with angle-iron braces.

The water heater is placed directly below and as near the radiator as possible.





With This Heater in Your Garage or Workshop, You Need Not Fear the Severest Weather; It Is Cheap, Easy to Construct and Very Effective

Two pipes are run from the heater coil to the inflow and outflow connections of the radiator. The overflow of the latter must be stopped up with a wood plug. Be sure that all connections are water-tight. A regular stovepipe carries off burned gases.

An expansion tank is fastened to the top of the radiator to provide for the condensation of any steam or water vapor, and for the expansion of the water. It should have an opening for filling the radiator with water, the opening being stopped with an ordinary cork, which will blow out should the heater flame be turned too high accidentally and cause steam pressure. In the outfit illustrated an oilcan was used. The system is not filled higher than the top of the radiator.

The water coil is heated with the burner from the gasoline camp stove, placed underneath the coils in the same position as a gas burner. The camp-stove fuel container will be large enough for use of the heater a half or full day at a time. For operation day and night, it is advisable to install a 5-gal. pressure tank fitted with a gauge. An ordinary tire pump can be used for pressure.

The heater is now finished except for inclosing the space around the fan. A sheet of galvanized tin is bent to the shape of an automobile hood, to fit the radiator at one end and reach to the wall at the other. This allows a forced draft of fresh air from the outside. A few ounces of aluminum paint will do wonders to make the entire heater an ornamental affair. The hood and radiator tanks, but not the heating surface of the radiator, should be painted. If any paint is used on the radiator fins, it should be thin and black.

Now fill the heater with water by pouring it into the expansion can. Enough water to reach the bottom of the can is sufficient. Generate the gas in the camp-stove burner in the usual manner and turn it on full blast. The water will be heated quickly, and then the flame can be turned down until it is barely burning. Start the electric fan, and the room will quickly be heated with circulating fresh air from outdoors.

From an economical standpoint it is desirable to keep the gasoline flame low at all times. The heater is so efficient in utilizing every available bit of heat, that the ease with which the room is kept at even warm temperature will be found surprising. Of course, the gasoline burner is used only where gas is not available. If it is, the gas is much more convenient. Even a kerosene burner, taken from an old stove, will provide sufficient warmth to keep a room at a comfortable temperature.

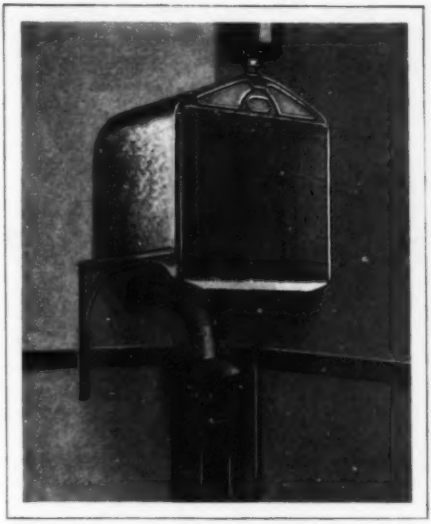


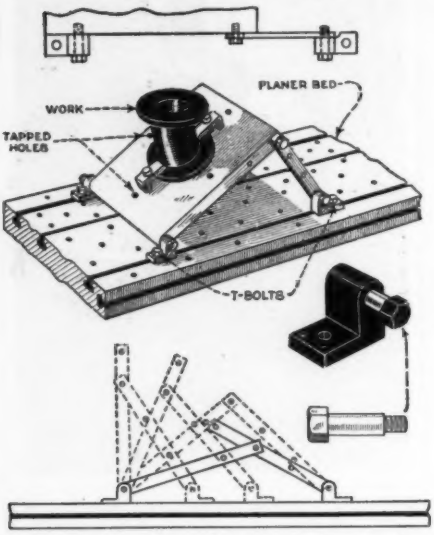
Photo of the Original Heater as Installed in a Restaurant; It Takes Little Room, and Is Economical

If the heater is to be installed in a room where inflammable liquids or vapors are likely to be present, it is a wise precaution to inclose the entire heating coil and burner in a screen of fine copper gauze. Ordinary fly-screen wire will serve. The screen should cover the whole unit, and be fitted closely around all connecting pipes. This will make the burner quite safe, on the principle of the miner's lamp.

Guide for Grinding Model-A Ford Valves

A discarded model-A Ford valve guide of the split type, with the sides dressed down slightly to make a loose fit, is useful for grinding the valves. The guide is inserted from the top in an inverted position. This is much better than putting the guides in from the bottom, as they have a tendency to fall out.

Angle Plate for Planer or Shaper

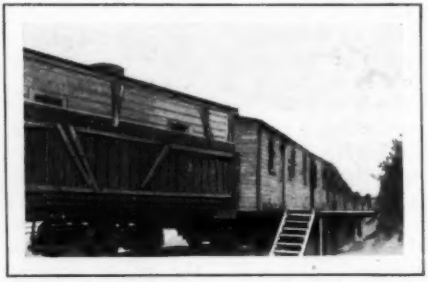


Universal Angle Plate Which Can Be Used on Any Planer or Shaper

The angle plate shown in the drawing can be adapted to any planer or shaper bed and is well worth the time spent in making it. The lower detail is a side elevation, and the dotted lines indicate various angles to which the plate can be set. The two front feet are hinge castings, one of which is shown in the detail. They must be faced off on both sides until their width equals the distance between the shoulders of the hinge studs with which they are fitted. The stud holes should be drilled and reamed to a snug fit. Drill and ream the front feet for dowel pins to fit corresponding holes in the planer or shaper bed so that the fixture always will be parallel to the cross-rail of the ram. The rear feet are somewhat similar to the front ones but narrower, allowing the legs, which are made of suitable bar stock, to be at right angles to the plate to which the work is attached. This is shown in the detail above the perspective view. No dowels are used in the rear feet, as this end of the fixture must be adjustable to the various angles desired. Capscrews are fitted to the rear feet as indicated, and are also used to fasten the legs of the angle plate. All four feet are held firmly in place on the planer bed by means of T-bolts. After the fixture has been assembled and doweled, a cut is taken across the plate, while flat, and center lines are cut with a tool so that the work can be more easily centered. Two rows of tapped holes in the plate will take care of almost any kind of work. The plate should be at least 1½ in. thick. No specific dimensions are given in the drawing, as the fixture must be made to fit the planer bed on which it is to be used.—Theo. H. Hansen, Clinton, Iowa.

Sidewalk Attached to Logging Train

This logging train has sidewalks attached to the sides by means of large hinges, enabling the walks to be folded against the cars when not in use. It is customary to park the train at one location for several weeks until the crew has finished its work there. Before the train was equipped with these walks, the occupants often had to walk through mud from one car to another, which is now eliminated, as planks are used for bridging the gap between walks on adjacent cars. When the train is moved, the walks are folded snugly against the side and are held in this position by large wooden turnbuttons pivoted slightly off center on heavy bolts so that they will not be turned to a horizontal position by the vibration of the moving train. Suitable folding legs are used to support the outer edge of the walks when let down, and a stairway is provided to facilitate getting on and off. —Carlton Groat, Portland, Oreg.



Folding Sidewalk Attached to Side of Bunk and Dining Cars of Logging Train

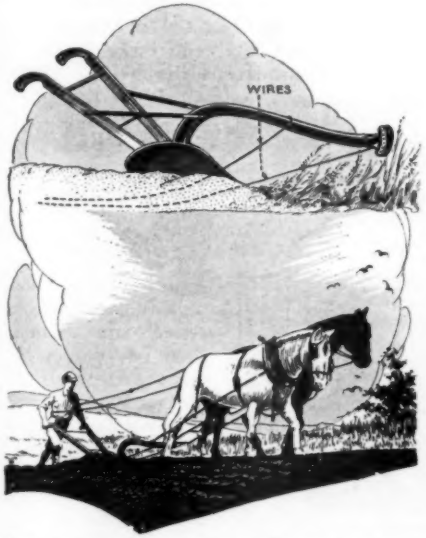
¶It is very poor practice to turn a reamer backward in a hole, as this will ruin its cutting edge.

Restoring Writing on Old Manuscripts

To restore faded or effaced ink writing on old manuscripts, moisten the writing with freshly made sulphhydrate of ammonia, and in a few moments the letters will become plainly visible. A fresh solution in water is colorless, but turns yellow quickly when exposed to air. The surplus chemical should be removed by washing with cold water, and the paper is then dried by slight heating or with blotting paper. If the writing again fades after this treatment, a tannin solution should be applied. This process is only useful for restoring ink made with gallic acid.

Effective Weed Hook

When the weed hook of my plow broke, I took two lengths of smooth wire and tied one of them to the front end of the beam and the other at the center, as shown in the upper detail. They were then allowed to drag on one side, being long enough to catch the dirt turned up by the plow, which holds them taut. Weeds are turned under more effectively with this arrangement than with any plow hook I have ever used.—Luther Strosnider, Onaga, Kans.



Two Lengths of Smooth Wire Tied to the Plow Beam Are Effective for Turning Weeds

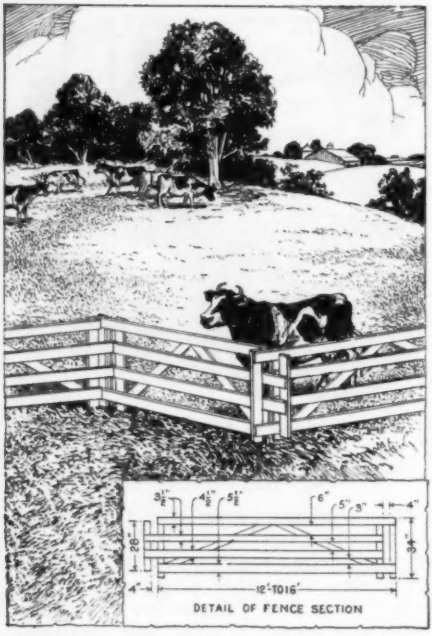
Air Pressure Applied to Valve Port Shows Whether Valves Are Leaky

Testing Auto Valves for Leaks

It is a comparatively easy task to test the valves on your car for leaks by following the method indicated in the drawing. A wooden or rubber plug, with a hole drilled through it to take the end of the pump hose snugly, is fitted into the spark-plug opening. A little lubricating oil is allowed to run around the edge of the valve. Then, with the thumb or finger of one hand pressing firmly down against the valve, give the pump a quick stroke with the other. If the valve leaks, bubbles will appear in the oil.—P. H. Stanley, Sacramento, Calif.

Simple Way of Cutting Glass Disks for Pressure Gauges

The small shop, not equipped with a circular glass cutter, can cut disks for steam and pressure gauges in the following manner: Fasten a wood disk to the faceplate of the lathe, having a diameter larger than the glass disk to be cut. Apply a thin coat of glue to both the surface of the wood and the glass. Place a piece of paper on the glued surface of the glass and then apply both to the glued surface of the wood disk. Rotate the lathe spindle by hand and at the same time hold a glass cutter against the glass at such distance from the center as to make a disk of the proper size. The disk can be removed easily before the glue hardens. —Arthur Hoem, Butte, Mont.



Zigzag Fence Made of One-Inch Stock Useful for Making Temporary Corrals

Portable Fence Requires No Posts

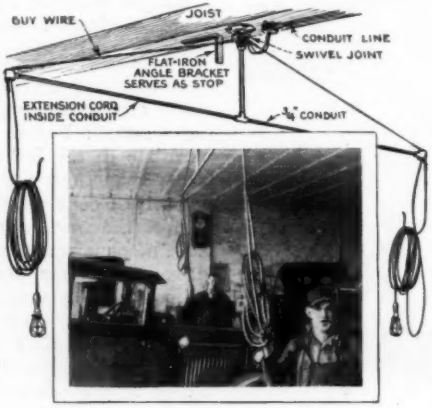
For use in constructing temporary corrals or other inclosures, a portable fence, requiring no posts but nevertheless strong enough for holding cattle, has been designed and used at the Washington state college. It consists of a number of sections which interlock and are light enough to be carried by one man. When set up, the fence somewhat resembles the homestead fence built of rails in zigzag fashion. The construction is simple, and the sections can be made of any desired size. One-inch stock, that may be either 4 or 6 in. wide, can be used for the purpose.—L. W. Pedrose, Seattle, Wash.

Drilling Holes in Wood with Nails

A number of small holes of special size had to be drilled in some thin strips of hardwood, but drills of the proper size were not at hand. Nails were used with good results in the following way: The heads of the nails were cut off; the ends were flattened and pointed slightly as on a flat drill, and the nails were then used in the same manner. They did the work nicely, as the material was not over ⅛ in. thick, although not so quickly as a drill. At another time, small holes were required in a set of lead-composition letters, to fasten them onto wood patterns. The letters were only ¼ in. high, and consequently the body was narrow. Small nails were used to drill these holes as described.

Rotating Holder for Garage Light Cords

Extension cords in garages, usually worn out too soon by letting them lie around on the floor, can be conveniently and safely kept on the rotating holder shown in the drawing. A frame is made of conduit or pipe in the form of an inverted "T," its length depending on the size of the room. The ends of the frame are supported by suitable guy wires as indicated, and the holder is hung from a ceiling joist by means of a swivel joint, which in this case was obtained from a discarded tractor. A flat-iron strip, bent over at right angles, is attached to the joist to serve as a stop to prevent the holder from making more than one revolution, which is not desired, as the wires, which are run through the pipe and around the swivel joint, would then be subject to constant twisting. Heavy wire hooks are provided at the ends of the holder where the extension cord is hung when coiled up.—Geo. R. Harrison, Council Bluffs, Ia.



Convenient Holder for the Garage Extension Cord Serves Wide Radius

Two Space and Time Savers for the Shop

By EDWIN M. LOVE

BUILT like a book, with three "leaves" of shelves, this small-parts cabinet holds its glass containers in a compact and orderly array capable of being indexed alphabetically, and cross-indexed with tabs on the edges as well. Casters on the base make it movable to any convenient spot.

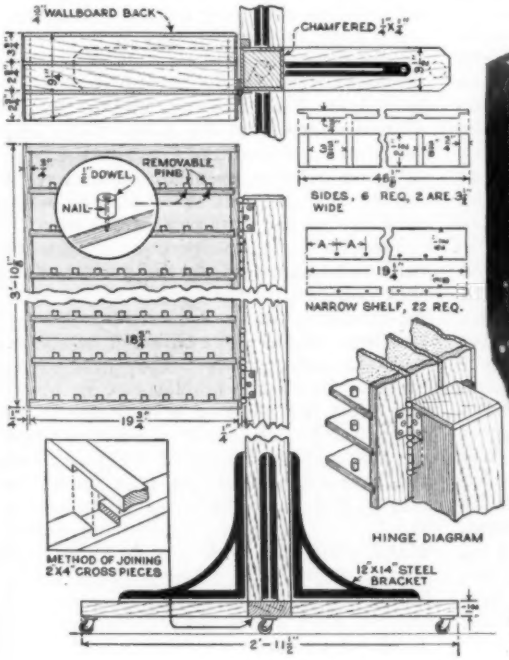
The dimensions may be varied to suit the need of the shop or garage. The writer built this case for use in his home workshop to provide containers for the thousand and one odds and ends heaped in boxes, everywhere in the way. Two leaves, 2½ in. deep, with a dozen shelves each, and a third, 3½ in. deep, with six shelves, give over 46 lineal feet of storage space, providing for 1½ gross of 3½-oz. jars, besides several larger glass bottles. Three other cases, hinged from the opposite side, would double the capacity.

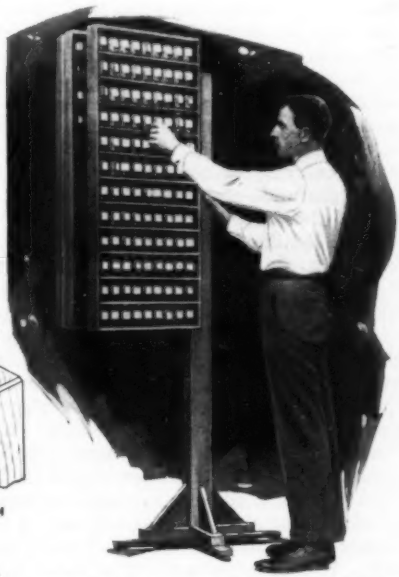
Select straight pieces of 1 by 3-in. pine, and cut four lengths to 3 ft. 10½ in. Mark the best faces to go inside. Taking one piece for a pattern and squaring from the front edges, score lines with a knife point across the inner face, ¾ in. from the upper end, and pairs of lines, ⅜ in. apart, every 3⅜ in. down the length, locating the shelf grooves or dadoes. Set a gauge for ¼ in. and mark the groove depth on both edges.

Mark the other three, set the gauge for ½ in., and scribe the ends for the corner rabbets, which are to receive the top and bottom pieces. Rip these ends before cutting the shoulders.

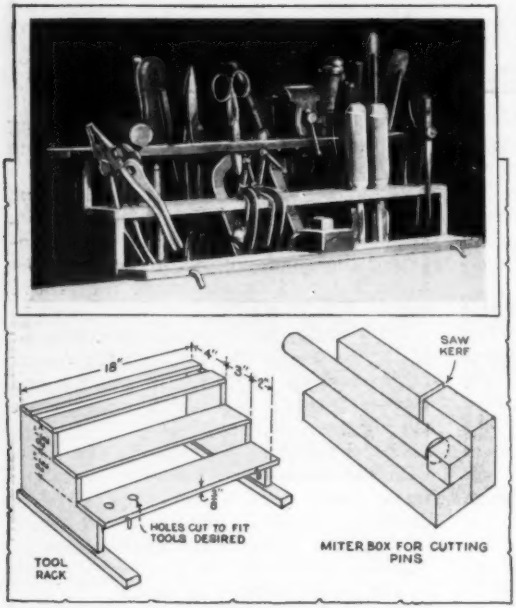
Cut the dadoes by splitting the lines, with the teeth of the saw cutting in the waste wood, and chisel to a uniform depth. A router is excellent for this, as it will insure accuracy of depth; and of course a dado head on a power saw will do the work quickly and well.

Cut twenty-two shelves from ⅜ by 3-in. clear-pine batten strips, which will be





With This Cabinet, All Small Parts Are Easily Found When Wanted and the Cabinet May Be Moved Close to the Job, If Desired



This Convenient Tool Rack Hooks onto the Back of the Bench, Keeping Tools Out of the Way, Yet Instantly Available

the same width as the sides. Be sure to measure all from the same shelf, or the last may be much longer than the first. The ends should fit snugly in their dadoes, without crushing, but if they bind too much, plane off a shaving or two on the undersides. Gauge a pencil line ½ in. back from the front edge of each; then mark centers for stop-pin holes, 2⅛ in. from the ends and 2½ in. apart for the rest of the distance.

To assemble, select a pair of sides and lay them on a bench with grooves up. Stand a shelf in each dado of one piece. Then lay the other side on the upper ends of the shelves, enter one or two more shelves and tack with a five-penny finish nail in each. Proceed in this way toward the other end, until all are entered, and then drive two more nails in each. Lay the frame down and lift the other side for nailing. Assemble the other frame in the same way, and add the tops and bottoms, which are of sized 1-in. stock, cut ½ in. longer than the shelves. Nail from the sides, top and bottom. The third case is built in the same way, but with wider stock and spaces between the shelves.

Square the cases by measuring from corner to corner rather than using a framing square from the side. Cover the backs with ¼-in. wallboard, cut to fit and secured with three-penny fine shingle nails driven in the sides and shelves. Do not slight this nailing, as the cases depend on their backs for rigidity. Trim off all outer corners with a chisel and plane and sand to ¼-in. radius.

The stand post is a 4 by 4-in. by 6-ft. pine stick surfaced on four sides to 3½ in. square. Square both ends and chamfer the upper end all around.

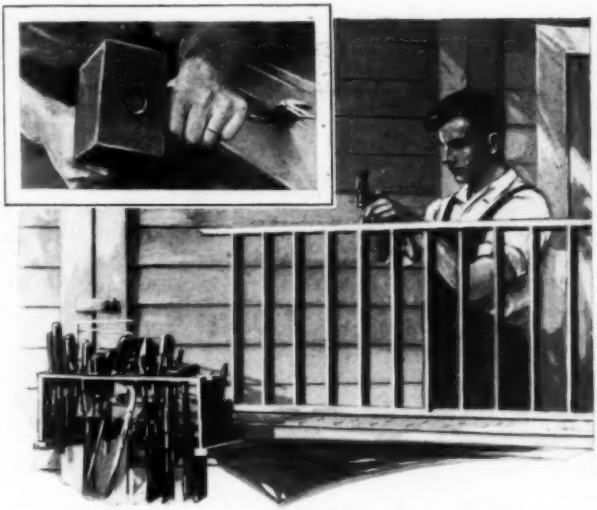
The base is made by crossing two pieces of 2 by 4-in. stock, 2 ft. 11½ in. long. Join them by notching in half the thickness, so that they will be flat, and clip the corner of the ends. Spike this cross to the lower end of the post. Brace it with four 12 by 14-in. steel brackets, or use wooden triangles nailed against the post and base. Add casters, preferably with wheels not under 1½ in. in diameter.

To hang the cases, gauge a pencil line on the right face of the post, 2½ in. from the front, and rest the large case on edge behind the line, the lower end at the desired distance from the base. Drive six-penny nails through the side into the post, at various angles, so as to get a dovetail effect. For strength, screw a ¾ by ¾-in. strip behind the post against the case.

The 2½ by 2½-in. loose-pin hinges are sunk full thickness into the post, so that they will rest on the surface of the middle-case side. Place them so that the upper hinge of the front case will be above, and the lower, below the middle-case hinges. Stand the middle case in place, and press the point of a knife crosswise of the joint at the top of the upper-hinge position and the bottom of the lower. Set the case aside, take the pins from the hinges, and mark the hinge lengths with the knife. Gauge for width and depth. Make cross cuts with a wide chisel and trim to depth, then to length and width. Screw the hinge halves in their mortises, and the other halves against the case side, and hang the case.

Now lay the cases flat, put the front case on top, and screw on its hinges, without troubling to mortise in. It may be necessary to relieve the back corners where they touch the hinges of the middle case.

Label the jars and place as desired on the shelves. It is quite easy to pick them out with the fingers, but a bent wire, hung from the post by a string, makes it easier. To prevent the jars from jostling out, cut ½-in. lengths of ½-in. hardwood dowel stock, drive a shingle nail through each, lengthwise, and insert in the shelf holes. To remove a jar, remove one pin. The cutting of these pieces is simplified if a miter box is used. This may consist of a 1 by 2-in. block nailed to the edge of another of the same size, with a saw kerf through the first. Nail a stop block ½ in. from the kerf, and push the rod against it for each cut.



Above, Cutting the Dadoes for the Parts Cabinet; Below, Mr. Love Nailing the Shelves in Place; Note the Tool Rack at the Left

The bench-tool rack shown in the photographs is the handiest, easiest built and cheapest that the writer has discovered to date. The construction is evident from the pictures. The ends are of three-ply ⅜-in. stock, and the tops are ⅜-in. strips. The top step is of two strips, so that hammer handles, etc., can be dropped between them. The lower step projects beyond the endpieces, and carries two screw hooks to clasp the rear rail of the bench-tool tray, while a strip nailed to the bottom of each end slips underneath the tray, providing a secure, yet instantly movable, grip. The tools are grouped according to their tasks, such as driving, shearing, rasping, holding and marking, with holes of such size as to hold their upper ends approximately level on each step, and open spaces are left between groups for future tools.

This rack is within easy reach, and, with a little practice, a tool can be placed there as quickly as it is laid carelessly on the bench top, thus avoiding the annoyance of moving tools to find room for the work, or of searching in the litter for small instruments that are easily misplaced.

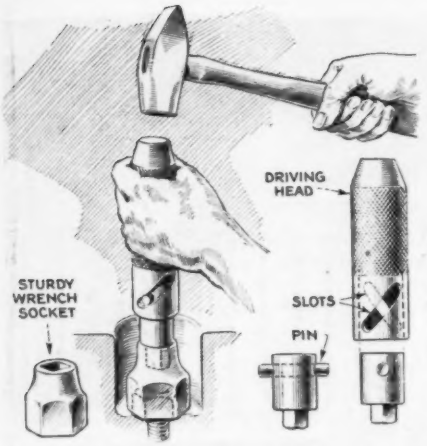
MATERIAL LIST

1 piece, 2 by 4 in. by 6 ft., pine, S4S.
3 pieces, 1 by 3 in. by 8 ft., pine, S4S, sanded.
1 piece, 1 by 4 in. by 12 ft., pine, S4S, sanded.
1 piece, 4 by 4 in. by 12 ft., pine, S4S.
2 pieces, ⅜ by 3 in. by 12 ft., pine batts, S4S, sanded.
1 piece, ⅜ by 3 in. by 14 ft., pine batts, S4S, sanded.
1 piece, ¾ by 4 in. by 9 ft., pine batts, S4S, sanded.
1 piece, ¼ by 48 in. by 6 ft., fiber wallboard.
Three-penny fine shingle nails.
Five-penny finish nails.
2 pairs 2½ by 2½-in. loose-pin butts.

Powdered Soapstone on Gaskets Prolongs Their Life

I have found that powdered soapstone makes the best parting I have ever tried on engine gaskets. Rub on the powder with a piece of felt. Parts can be taken off very easily without breaking gaskets when this method is used.—A. Gemmell, Ansonia, Conn.

¶A mechanic should never wear jewelry on the hands while working at a machine as it is apt to catch on the work and cause serious injury.



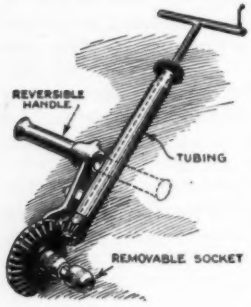
Simple Tool for Starting Nuts and Bolts in Places Difficult of Access

Tool for Starting Nuts

A tool for starting stubborn nuts and bolts in cramped quarters is shown in the illustration. It is made suitable for use with any unit of a full set of sockets and consists of a steel bar drilled for a socket stock. Two diagonal slots are cut for a driving pin through the stock. The top part is knurled for a handgrip, and the other end is squared to fit the sockets. A crosspin engages the slots in the driver. In use, the tool is placed on the nut, the driver raised and held by the left hand, and the top is given a sharp hammer blow. —G. A. Luers, Washington, D. C.

Generator Wrench for Model-T Fords

Every mechanic who has worked on Ford model-T motors knows how difficult it is to remove the bottom screws on the generator. The wrench shown in the drawing was made especially for this work and was found entirely practical. It consists of an axle-shaft gear, a Ford differential gear, with a bracket fashioned from a motorcycle connecting rod and a housing from a Chevrolet steering column. The small gear is fastened to a length of ⅜-in. rod with a T-shaped handle at the end. The other gear is fitted with a removable socket on each side and a reversible handle is provided so that both sides of the wrench can be used for different nuts.—M. Coffman, Cleburne, Tex.



Test for Distinguishing A.C. and D.C. Currents

Here is a method I used to determine whether a line current is alternating or direct. I held one pole of a horseshoe magnet, taken from an old magneto, against a lamp of the carbon-filament type. Immediately the filament began to vibrate back and forth, toward and away from the magnet pole, the frequency of vibration being the same as that of the frequency of the line current, which in this case was alternating. The vibrating filament produces an illusion of a wider area of incandescence than that produced when the filament is still. When I tried the same experiment on a carbon lamp in a direct-current line, no fluctuations were noticed.—Neil D. Cameron, Vancouver, British Columbia.

Ejector for Draining Cesspool

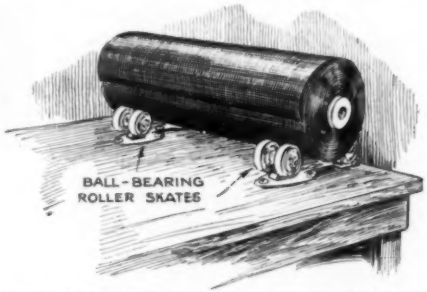
For draining a cesspool, or any other similar tank or well, a Y-fitting like that indicated in the illustration, slipped over the nozzle of a hose, will be found useful. The path of the water is through the straight section of the fitting, which causes suction at the other end of the Y. A length of hose attached to this end is lowered into the cesspool or other tank to be emptied.

Reclaiming Old Gold for Sale to Mint

To sell scrap gold to the United States mint, it must be reduced to almost pure gold or about 24 carat. Melt the junk and roll it into very thin sheets. Place them in a bowl, so that the pieces will not lie together, and pour chemically pure nitric acid over them. This will separate the gold from the base metal, the latter being dissolved and the gold forming a powder on the bottom of the vessel. After this powder has formed, pour off the acid, put water into the vessel, and shake well, after which allow it to settle, then pour off the water. Repeat this washing several times to free the powder of all the acid. Allow the powder to dry, and put it in a crucible with some flux, pearlash or bicarbonate of soda. Melt it into a lump in the bottom of the crucible. This will be almost fine gold, but not absolutely pure. While melting, be careful not to inhale the fumes, as the remaining acid that cannot be washed out is highly injurious to the lungs.

Roller Skates for Screen Holder

Roller skates, turned upside down and nailed to a counter at one end, make a good holder for a roll of screen in the hardware store. The roll turns easily when mounted in this way and its weight prevents it from being dislodged easily. Obviously, this holder saves considerable work and time, as a roll laid on the counter sometimes becomes unmanageable, and always is more or less difficult to handle.—George R. Harrison, Council Bluffs, Iowa.



Handy Holder for Rolls of Screen Can Be Made from a Pair of Roller Skates

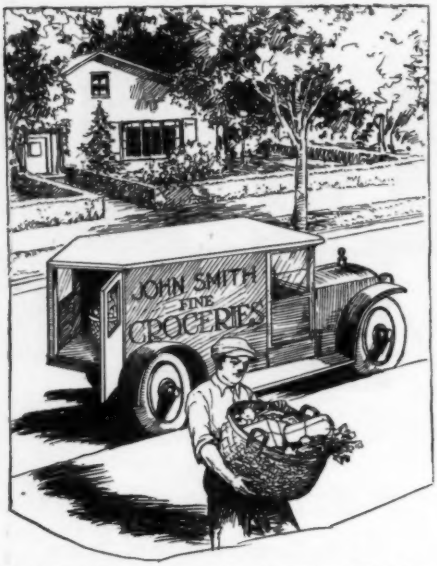
Stand Equipped with Electric Motor for Rotating Barrels While Spray-Painting Them

Rig for Spray-Painting of Drums

In a western concern, where considerable time was consumed in painting oil drums, the illustrated device was made to speed up the work, with gratifying results. The base consists of two drums connected with flat-iron braces. A Ford front axle was fastened across the tops of the drums and the spindles turned upward, after which they were locked in position. Old auto wheels set up on the spindles were rotated at slow speed by means of an electric motor mounted between the barrels, as indicated, a single ½-in. belt passing over both wheels and over the motor pulley. The drums to be painted are placed on the wheels and rotated while the paint is applied, allowing the man to remain stationary while he works.

Semi-Streamlining Truck Bodies

Impressed by the importance of streamlining in airplanes and racing cars, the



Semi-Streamlining Delivery Trucks Reduces Wind Resistance and Provides More Storage Space

owner of a fleet of light delivery trucks investigated the possibilities of adapting the design to his truck bodies. He found that it would not be practical to streamline them entirely, but that the effect could be approximated at little expense. An experimental model, shown in the drawing, proved to have greatly reduced wind resistance, especially when traveling against the wind at 40 miles per hour. A gasoline saving of five miles per gallon was effected. The additional section built onto the back also provided greater space and made loading and unloading easier. The results completely satisfied the owner so that he altered all his trucks in the same way.—R. F. Starzl, LeMars, Iowa.

Magnetic Chip Remover

When drilling holes in stationary steel or iron, such as machinery, some of the chips are likely to remain in the hole. To remove them, get a magnet and suspend a nail from one pole. Lower the nail into the hole and you will find that the chips will adhere to it. Any kind of a light horseshoe magnet can be used for this purpose. If a large number of holes of the same size are to be drilled, in production work, a piece of steel of slightly smaller diameter than that of the holes may be split about two-thirds of its length and then magnetized, which will be found to be handier than the use of a separate magnet and nail.

Nails for Mixing Paints

After a can of paint or lacquer has been left on the shelf for some time, the pigment settles to the bottom and it is then rather difficult to mix it thoroughly. One method of hastening the mixing process is to put a small handful of clean nails in the can. Thereafter the paint can be mixed quickly by shaking the can, as the nails beat up the pigment.—Blair L. Gilbert, Chicago.

Removing Small Cotter Keys

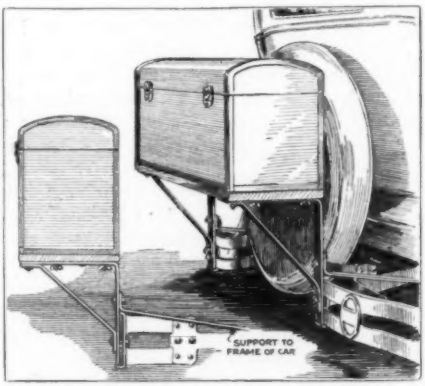
Small cotter keys, 1/16 in. and smaller, are frequently rather difficult to remove, particularly when they are slightly rusted, and the usual snub-nose pliers happen to be the only tool available. Attempting to get the cotters out with the pliers alone often results in crushing the eye or in breaking it off completely. A good method of removing the cotter is to take a short piece of the tough wire used as a hinge pin of a tobacco can, or similar wire, and bend it to form a small "V," one end of which is inserted through the eye of the cotter. Then grip the ends of the wire as shown in the photo, and the pin can usually be pulled out easily, with the eye remaining in good condition. If the eye does break, one side will invariably snap first, leaving a good bit of the other end or side to grip with the pliers.

Bright Finish on Screw Threads

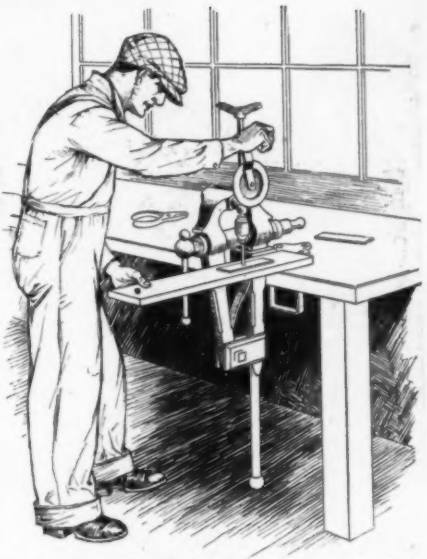
In working tool steel, it is always difficult to produce a good finish by any other means than grinding, and this cannot be done to screw threads. Where a thread is used in toolmaking, a good, smooth finish is desirable, not only as a matter of appearance, but to maintain the accuracy and lengthen the life of the thread. The best method is to turn the threads to size, then procure a piece of soft wood and hold it against them. Dip it in oil, then in No. 0 or 00 emery, and chase over the threads. It will be impossible to remove over .001 in. of the material in this way, and a fine, ground finish is obtained quickly and in an inexpensive manner. Many things can be lapped in this simple way.—J. B. Murphy, Plainfield, N. J.

Combination Bench and Tool Box on Auto

Service men and others who use a pleasure car for carrying their tools to work will find the combination bench and tool box shown in the illustration practical and convenient. It eliminates the habit of cluttering the floor of the car with tools that may soil and tear the upholstery. The supports for the bench are made of heavy flat iron, bent to the shape indicated, and clamped to the rear bumpers. An additional brace of the same material is bolted to each bench support and to the frame of the car. Use a piece of hardwood, such as oak, maple or hickory, for the bench top and bolt it to the supports. The tool box can be built to fit the dimensions of the bench top, or, if desired, a regular auto trunk can be used for the purpose. Holes are drilled through the bottom of the tool box and bench top, and the two are then firmly fastened together by means of bolts fitted with wingnuts.—M. L. Harmon, South Bend, Ind.



Bench Top and Tool Box Attached to Rear Bumpers



Hand Drill Held in Vise with a Board under Work to Provide Force Feed

Improvised Force-Feed Drill Press

Those who have only an ordinary breast drill can easily improvise a drill press as shown in the illustration. Grip the side handle of the drill in a vise, attached to the bench top, so that the drill point is a short distance above the level of the top. Then place, or clamp, the work on a piece of 1-in. stock, set one end on the bench and draw up on the other end with the left hand while turning the crank of the drill with the right. I have found this method very useful in drilling hard steel, which requires considerable pressure. Besides the feature of having a force feed with little exertion, this method insures drilling to size.—Luther Strosnider, Onaga, Kansas.

¶The best ratio of heating to grate surface is about 35 to 1, and grate area to draft area 8 to 1.

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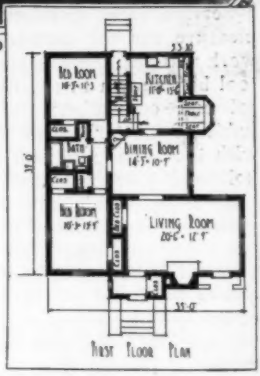
PLAN 5-S-30

A Better Investment Than Wall Street Can Offer



YOUR dollars put into a bungalow of this type are not only well invested with more liquid and assured market value than many a high-priced stock, but they buy a house with as large an amount of service, comfort and convenience within small area as it is possible to design.

If your preference runs to living rooms across the front you have one here with exposure on three sides. Furthermore, you have three-bedroom equipment without the expense of a third sleeping room. The carefully placed bed closet in the living room provides extra service when you need it. That's a saving of between $500 and $1,000.

Every modern service feature is included in this bungalow; features that give a house ready resale market. What are they? A fireplace, a breakfast alcove; built-in china cabinet; abundance of closet space; a scientifically planned kitchen with dirt and dust-proof cabinets; a colorful modern bathroom and extra space on the second floor for storage and sleeping quarters when required.

Here's a bungalow of the proportions and refinements that would do justice to a much more expensive house. What about cost? As it stands, the house has been built for as low as $5,500. Costs, however, will vary, depending upon location and equipment.

Construction is frame with stucco on metal lath. Solid masonry is satisfactory. Common brick whitewashed, brick veneer and skintled brick are all adaptable to this style of dwelling. You'll not find a better plan of more assured investment and resale values. You can't go wrong on this house.

Popular Mechanics Magazine will supply readers a one-sheet blueprint of any house appearing in the magazine for $1, and a new bungalow book will be sent for ten cents.